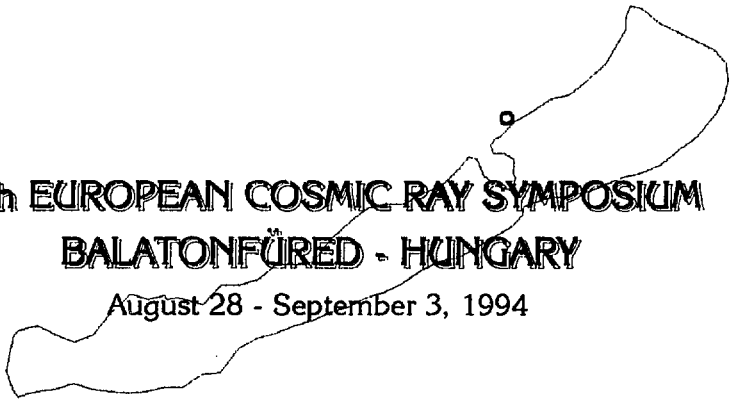

14th EUROPEAN COSMIC RAY SYMPOSIUM

BALATONFÜRED - HUNGARY

August 28 - September 3, 1994

SYMPOSIUM PROGRAM
AND
ABSTRACTS

August 1994

Welcome

to the

14th European Cosmic Ray Symposium

The 14th European Cosmic Ray Symposium
is organized by
the Space Physics Department
of the KFKI Research Institute of Particle and Nuclear Physics
of the Hungarian Academy of Sciences
under the auspices of
the Cosmic Ray Commission of IUPAP,
the Section of Physics of the Hungarian Academy of Sciences,
the Hungarian Space Office,
sponsored by
the Hungarian Astronautical Society
and
COSPAR

LOCAL ORGANIZING COMMITTEE:
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H-8230 Balatonfüred, Széchenyi u. 20
Hungary
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14th EUROPEAN COSMIC RAY SYMPOSIUM
BALATONFÜRED - HUNGARY

August 28 - September 3, 1994

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Introductory Remarks

Six years ago not many of us would have thought that the European Cosmic Ray Symposium was to return to the shores of the Lake Balaton so soon. We hope that the present interest is at least partly due to the pleasant memory of the 11th ECRS. Not only the number of participants, but also that of accompanying persons has now greatly increased.

In the past six years substantial changes have taken place in this part of the world. Most participants may have noted with satisfaction that visa are now rarely required. Hungary has become more accessible - but also more expensive. It is the latter aspect that has made the job of organizers somewhat difficult. We are grateful, in addition to our sponsors, to ISF for the support of several FSU scientists, to Elsevier for the generous and flexible terms on publishing and distributing the Proceedings of invited and highlight talks, and, last not least, to invited and highlight speakers for their help and understanding.

The organization of European Cosmic Ray Symposia mostly involves a certain amount of experimentation. This time, we tried to emphasize some important topics, and arranged the material into eight topical groups or mini-symposia. Details of topics and of coding conventions for papers and sessions will be explained in the section on 'Scientific Organization'. Also, a Discussion and Conclusions session has been introduced for the last day of the Symposium, involving both some invited mini-rapporteur talks (or rather personal impressions on progress and prospects), and general discussion. Some of those new features might survive the present Symposium. We are grateful to members of the International Advisory Committee for their valuable advice. We regret that - in spite of contrary advice - the oral program has become somewhat overloaded (particularly on Tuesday, when an evening session had to be introduced). As we hope, that feature will not survive.

The present booklet contains a section on general information, followed by some details of the scientific organization. The structure of the Symposium will be presented both in a schematic, tabular form, and as a day-by-day program. A list of submitted papers in short form follows (only one author, with an abbreviated form of long titles), in the order of mini-symposia. Then come the full Abstracts, in the same order.

We wish you a pleasant and useful Symposium.

National Organizing Committee

Local Organizing Committee

Registration

The Conference Registration Desk will be located in the entrance hall of Hotel Füred from Sunday noon to Tuesday 10 a.m. Please contact the LOC office for later registrations (open 8 a.m. - 10 p.m. every day at room 311). All fees including accommodation and board have to be paid at registration.

The **name badges** are colored as follows: White – participants, Green – accompanying persons, Red – members of the National and Local Organizing Committee.

Exchange Desk

The personnel of Hotel Füred operates a desk to facilitate exchange of foreign currency (cash or traveler's check) against Hungarian Forints (HUF). The exchange rate has changed since the issue of the Third Circular.

Messages

A board will be set between the two session rooms to post messages for participants. Alternatively, one can leave messages at the hotel registration desk.

Meals

A buffet breakfast is provided at your hotel from 7 a.m. to 10 a.m.

Participants who get partial or full board are kindly requested to go to the restaurant of Hotel Füred at 1 p.m. for lunch and at 7 p.m. for dinner. Please, give your meal ticket provided at registration to the waiter.

A la carte meals at extra costs are served at the restaurant of Hotel Füred from noon to 3 p.m. at lunch time and from 6 p.m. at dinner time. There are several other restaurants, grills, and pizzerias in the area, most of them in direction downtown Füred.

A mini market within walking distance (direction downtown Füred) is open all day.

Making Phone Calls

The telephone at your hotel room can be used for long distance calls by calling the operator of the hotel. Please do not forget to pay your phone bill before departure.

You can call direct from the dial-telephone at the entrance of the hotel by using coins or a Hungarian telephone-card.

Copying Facilities

Copying service is available at Hotel Füred. The machine is operated by the hotel personnel at a charge of 12 HUF per page. Please contact the hotel registration desk directly.

Departure

On the day of your departure you have to leave your room by 10 a.m. Your luggage can be stored at the LOC office.

Timetable of trains from Balatonfüred to Budapest Déli pu.

B.füred dep.	0736	0956	1152	1408	1415	1538	1759	1926
Budapest arr.	0938	1228	1423	1618	1718	1813	2028	2128

The train leaving at 7.36 a.m. is an express train, seat reservation is required.

Social Events

Monday, 29 August

8 p.m. Welcome party at Hotel Füred. Snacks, beer, wine, and soft drinks will be provided.

Tuesday, 30 August

2 p.m. - 6 p.m. Accompanying persons' excursion to the famous (more than 150 years old) china manufactory and museum of Herend. Preference will be given to accompanying persons because of the limited number of seats on the bus. Please contact the LOC if you would like to participate.

Wednesday, 31 August

2 p.m. - 10 p.m. Conference excursion to Veszprém, Tihany, and Nemesvámos.

2 p.m. Buses leave from Hotel Füred for Veszprém.

3.30 p.m. After sightseeing at Veszprém buses leave for Balatonfüred pier.

4 p.m. Boat trip from Balatonfüred to Tihany, transfer by bus to the Abbey Church.

5.30 p.m. Organ concert at the Abbey Church of Tihany
Performer is János Solymosi

CONCERT PROGRAM

I. HUNGARIAN BAROQUE ORGAN MUSIC
1. *Praeambulum (from the music collection of the cathedral of Veszprém)*
2. *Aria sub Requiem (from the note-book of Ferenc Pokorny)*
3. *Ferenc Miklós Novotny* (1742-1793): *Praeludium*
4. *Antal Zimmermann* (1741-1781): *Praeludium*

II. EUROPEAN BAROQUE ORGAN MUSIC
1. *Antonio de Cabezon* (1510-1568): *Variations for a courtly theme*
2. *Girolamo Frescobaldi* (1583-1643): *Two fugues*
3. *Jean-Francois Dandrieu* (1682-1738): *Basse de Cromorne, Ofertoire*
4. *Johann Sebastian Bach* (1685-1750): *"Wir glauben all an einen Gott" - chorale prelude, Fantasia con imitazione*

III. *János Solymosi: Organ partita for the church folk theme "Blessed Virgin Mary"*

6 p.m. Transfer by bus to the "Betyárcsárda" of Nemesvámos where dinner and folklore program will be provided.

Thursday, 1 September

8 p.m. Symposium banquet at Hotel Füred.

The costs of the above listed programs are included in the registration fee of the participants and accompanying persons.

Excursions to other places of interest (e.g. Budapest) are regularly organized by the Tourist Office of the hotel at extra costs. Please contact the Tourist Office if you are interested.

SOME LIGHT-HEARTED COMMENTS

(taken from the Berlitz guidebook on Hungary, 1990 edition):

Balatonfüred

Here you can wash down the local wine with the local mineral water. This busy pleasure port has a long history as a spa. The water is dispensed to the public from a pagoda-like well-head in the middle of Gyógy tér (meaning Cure Square). You may not find the water refreshing. It's cool enough, but the taste - as if the pipe were rusty - hints at its medical properties.

In the most imposing building facing the square, the Heart Hospital, some 10,000 patients are handled per year. Balatonfüred's mineral water was found to help the treatment of heart diseases.

Between the square and lakefront, a large park shaded by century-old planes and poplars is studded with statues traditional and modern. The subjects range from Girl Playing Lute to The Fisherman and The Ferryman, right alongside the water, to Balaton Wind on the pier.

Veszprém

This county seat in the Bakony mountains claims to have nearly 200 historic monuments.

Castle District. The old town occupies a bluff that reveals a stirring panorama of Veszprém and its countryside. Heroes' gate leads from the more lively part of the town up to the castle area. Stones from the original medieval castle were used for the modern reconstruction. The zone beyond the gate is so narrow that there is room for only one street. Of all the historic buildings, in various styles and colours, the most significant may be the two-storey Episcopal Palace. It was completed in 1776, using the stones from the original royal palace that had stood on the site since the age of King Stephen. It was the Bishop of Veszprém who traditionally crowned the queens of Hungary.

Next to the Bisop's Palace is the **Gizella Chapel**, with its 13th century frescoes restored. The chapel has been ruined and rebuilt several times.

Further up the hill, the two-towered **Cathedral**, dedicated to St Michael, has a history going back nearly a thousand years. Very few vestiges of the original church remain. Over the centuries a series of disasters - the Mongol invasion, the Turkish siege, the Austrian assault, plus several apparently accidental fires - gave architects and reconstruction crews many opportunities to try new ideas. After going through Romanesque, Gothic and Baroque phases, the church was finally reconstructed at the beginning of the 20th century in neo-Romanesque style. Several of the altars and side-chapels are considered valuable works of art.

Tihany

The Tihany peninsula is largely given over to a national park. The peninsula protrudes to within about a mile of the south shore. It's all too pretty to be left to the birds, and in fact parts of the peninsula suffer their share of the tourist invasion, but still there is plenty of unspoilt woodland - and the best views along the whole coast.

Life here is a split-level affair. An ancient church stands on a precipice overlooking the port, and at lower altitudes there's a village and a couple of independent lakes; by Balaton standards they're only ponds, but very popular with the waterfowl.

Starting at the top: the clifftop **Abbey Church**, an 18th century Baroque construction, features some angelic decorations - the interior walls look as if they contain more cherubim per square metre than anywhere else on earth. The church rises above a crypt nearly 1,000 years old. Here stands the tomb of King Andrew I, founder of this Benedictine abbey. In a country ravaged by so many invasions, the Romanesque crypt represents a rare survival from the earliest times of the Hungarian nation. King Andrew is also commemorated in a joltingly contemporary sculpture in front of the church - a stone figure wrapped in an aluminium cloak.

The streets and lanes along the upper reaches of Tihany charm visitors. They're lined with thatched, stone cottages in traditional style. The reeds used for thatching, which grow profusely in the lake along the northern shore, help to keep the water pure as well as adding to the mood of Balaton.

At an altitude of 25 metres above Lake Balaton, the peninsula's **Inner Lake** yields tons of fish every year. Because it is so small - less than half a mile long - the green hills surrounding the little lake look almost like real mountains. To the south are the domes of defunct geysers - relics of some violent hot springs.

EMERGENCIES

In case of emergencies please contact the LOC Office (Room 311) or the hotel registration desk.

Scientific Organization

MINI-SYMPOSIA

The scientific program of the 14th ECRS is organized around the following eight topical groups or mini-symposia:

1: **The Sun and its effects on the inner heliosphere**
2: **Ulysses, 3D structure, anomalous component, modulation**
3: **CR variations, fluctuations, fractals**
4: **Prospects and results of accelerators and CR physics**
5: **Galactic acceleration and propagation below 1 TeV**
6: **Gamma-ray astrophysics**
7: **Around and above the "knee"**
8: **Large detector systems and methodology.**

Although most of the mini-symposia are closely related to one of the conventional fields (SH, OG, HE), we use the mini-symposia as the primary means of classification. The eight topics together more or less cover the conventional fields (even with some overlaps).

TYPES OF PRESENTATION, LECTURE ROOMS

Invited talks (INV) are presented on plenary sessions in the main lecture room (Room B). Highlight (HL) and Contributed (C) talks are presented on parallel sessions. There are only two parallel sessions at any time (in Rooms A and B). Both lecture rooms are easily accessible at the first floor of Hotel Füred.

POSTERS

Help with the mounting of posters will be provided by the organizers. No pins or tacks, only sticky fixers should be used (ask for it). Most posters are expected to be mounted on Sunday afternoon and on Monday. Poster papers (denoted by P) will be on show throughout the week in an area close to the lecture rooms.

Dedicated Poster Sessions will be held at 17:00 to 18:30 on Thursday. Presenters are expected to be near their poster at that time. If there is sufficient interest, they also have the option to present their poster orally in one of the two lecture rooms (topics 1-3 in Room A, topics 4-8 in Room B). Those wishing to give an oral presentation of a poster paper should contact the Session Chairmen (J. Kóta for topics 1-3, J. Szabelski for topics 4-8) as soon as possible.

SESSION CODES AND PAPER CODES

Invited Sessions, i.e. plenary sessions where Invited talks are presented, are numbered from IS1 to IS7. An additional plenary session is the last full-length session of the Symposium (just before the Closing Ceremony), dedicated to discussion and conclusions.

Parallel sessions are dedicated to the presentation of Highlight (HL) and Contributed (C) oral papers. Eight such pairs of parallel Oral Sessions are planned, numbered from OS1/A to OS8/B. Each parallel session also forms part of a mini-symposium, and gets a topical code accordingly (e.g. 8/4 means the 4th session of mini-symposium No. 8).

Invited talks are numbered in the order of presentation (INV-1 to INV-18).

Codes of Highlight, Contributed, and Poster papers consist of three parts, the first one giving the serial number of the mini-symposium, the second one the conventional classification, while the third part gives the serial number (within the given symposium) and the type of presentation (HL, C, P). Thus e.g. 7-OG-5HL gives the 5th paper (which is a Highlight) in mini-symposium 7, with conventional OG classification. For mini-symposium 8 no satisfactory conventional classification was found, thus it is replaced by LSD (for Large Detector Systems).

Program information

In this booklet, information on the scientific program is available in two forms: a schematic representation of the timetable, and a more detailed, day-by-day Symposium Program. The papers submitted are also listed in two forms: first a list of paper codes, of submitting/presenting authors, and of short titles is given for the eight mini-symposia, then full abstracts follow.

Technical facilities

Two overhead projectors and one standard (5cm x 5cm) slide pojector will be available in each session room. For information on any other facilities please contact the organizers.

Proceedings

Invited and Highlight talks will be published in the Proceedings Supplement of Nuclear Physics B, as was the case for the two previous ECRS. Because of the large number of invited and highlight talks (18+16), some page number limitations will have to be imposed. Details on length and deadlines will be discussed at the ECRS.

<table>
<tr><th></th><th></th><th>Su 28</th><th>Mo 29</th><th>Tu 30</th><th>We 31</th><th>Th 1</th><th>Fr 2</th></tr>
<tr><td rowspan="20">Regis-
tration</td><td>0830</td><td rowspan="2">Registration</td><td rowspan="3">IS4 Shea
Drury
Aharonian</td><td rowspan="3">IS5 Panasyuk
Kóta
Chudakov</td><td rowspan="3">IS6 Wolfendale
Nikolsky
Cane</td><td rowspan="3">IS7 Jenni
Fenyves
Dau</td></tr>
<tr><td>1000</td></tr>
<tr><td>1100</td><td>Opening + IS1
Wenzel</td></tr>
<tr><td></td><td>Break</td><td colspan="6">Break</td></tr>
<tr><td>1200</td><td rowspan="2">IS2 Balogh
Klecker</td><td>OS2/A
1/1</td><td>OS2/B
6</td><td>OS6/A
2/2</td><td>OS6/B
8/4</td><td>OS7/A
1/3</td><td>OS7/B
7/2</td><td rowspan="2">Discussion
& Conclusions</td></tr>
<tr><td>1300</td><td colspan="6">Lunch break</td><td>Closing</td></tr>
<tr><td>1400</td><td rowspan="5">Excursion</td><td rowspan="5">Special
meetings
and
Informal
discussion</td></tr>
<tr><td>1500</td><td rowspan="3">IS3 Chupp
Erlykin
Stamm</td><td rowspan="2">OS3/A
5/1</td><td rowspan="2">OS3/B
7/1</td><td rowspan="2">OS8/A
3</td><td rowspan="2">OS8/B
4</td></tr>
<tr><td>1600</td></tr>
<tr><td>1700</td><td>Break</td><td colspan="2">Break</td><td colspan="2">Break</td></tr>
<tr><td>1800</td><td>OS1/A
2/1</td><td>OS1/B
8/1</td><td>OS4/A
5/2</td><td>OS4/B
8/2</td><td colspan="2">PS</td></tr>
<tr><td>1900</td><td colspan="4"></td><td colspan="2"></td></tr>
<tr><td>2000</td><td colspan="2" rowspan="2">Welcome</td><td rowspan="2">OS5/A
1/2</td><td rowspan="2">OS5/B
8/3</td><td colspan="2" rowspan="2">Banquet</td></tr>
<tr><td>2100</td></tr>
</table>

Notations:

IS1...7 = Invited Sessions
OS1...8 = Oral Sessions
PS = Poster Session
/A = Room A
/B = Room B
1...8 = Mini-symposia
/n = nth session of a Mini-symposium

Example:

OS4/A = Oral Session 4, Room A
5/2 = 2nd session of Mini-symposium No. 5

Warning: times indicated in the above table are approximate.

MONDAY, 29 AUGUST

10:00 Opening and Invited Session 1 Room B Chair: P. Király

Opening	20'		
INV-1	40'	**K.-P. Wenzel:**	The Ulysses mission: a voyage across the poles of the sun

11:00 *Tea and Coffee break*

11:20 Invited Session 2 Room B Chair: K.-P. Wenzel

INV-2	40'	**A. Balogh:**	The high-latitude heliospheric magnetic field
INV-3	40'	**B. Klecker:**	The anomalous component of cosmic rays: a review and new results from Sampex

Lunch break

15:00 Invited Session 3 Room B Chair: A.J. Somogyi

INV-4	40'	**E.L. Chupp:**	Properties of solar flare acceleration from multiwavelength observations
INV-5	40'	**A.D. Erlykin:**	Around and above the "knee"
INV-6	40'	**W. Stamm:**	The HEGRA project

17:00 *Tea and Coffee break*

17:15 Oral Session 1/A Room A Chair: B. Klecker

Ulysses, 3D structure, anomalous component, modulation (2/1)

2-SH-1HL	30'	**H. Kunow:**	High energy cosmic-ray results from the Ulysses ascent to the solar south pole
2-SH-2HL	30'	**E. Keppler:**	Low energy particle observations in high heliographic latitudes: ULYSSES
2-SH-3C	20'	**R. Beaujean:**	Heavy ion measurement on LDEF

17:15 Oral Session 1/B Room B Chair: W. Stamm

Large detector systems and methodology (8/1)

8-LDS-1HL	30'	**E. Lorenz:**	The wide angle air Cerenkov telescope AIROBICC, a prototype for a future high sensitivity, low threshold cosmic ray detector
8-LDS-2C	10'	**E. Lorenz:**	First results from observations with the wide angle air Cerenkov detector AIROBICC in combination with the HEGRA array
8-LDS-3C	15'	**R. Mirzoyan:**	Performance of the HEGRA air Cerenkov telescope system
8-LDS-4C	15'	**F. Arqueros:**	Monte Carlo simulation of the HEGRA cosmic ray detector performance
8-LDS-5C	20'	**B. Degrange:**	The CAT project in VHE γ-ray astronomy

Dinner break

20:00 *Welcome party*

TUESDAY, 30 AUGUST

8:30 *Invited Session 4* *Room B* *Chair:* **G. Wibberenz**

INV-7	40'	**M.A. Shea:** History of solar proton prediction
INV-8	40'	**L. Drury:** Ultra heavy elements in the cosmic rays
INV-9	40'	**F.A. Aharonian:** VHE gamma-ray astrophysics

10:30 *Tea and Coffee break*

11:00 *Oral Session 2/A* *Room A* *Chair:* **E.L. Chupp**

The Sun and its effects on the inner heliosphere (1/1)

1-SH-1C	25'	**R. Ramaty:** High energy processes in the June 1991 X-class flares
1-SH-2HL	30'	**D.F Smart:** Solar, interplanetary, and geomagnetic phenomena in March 1991 and their association with spacecraft and Terrestrial problems
1-SH-3HL	30'	**E.O. Flückiger:** Status report on the study of cosmic ray particle propagation in the Earth's magnetosphere
1-SH-4C	10'	**R. Bütikofer:** The solar proton event of the 1990 May 24 solar flare

11:00 *Oral Session 2/B* *Room B* *Chair:* **F.A. Aharonian**

Gamma-ray astrophysics (6)

6-OG-1HL	25'	**A.A. Stepanian:** On the Crab nebula VHE gamma-ray flux
6-OG-2C	20'	**A. Djannati-Atai:** The Crab gamma ray spectrum revised in the range 3 to 15 TeV
6-OG-3C	15'	**Y. Gallant:** The VHE gamma-ray spectrum of the Crab Nebula
6-OG-4C	15'	**M. Pohl:** High energy gamma rays from the Galactic Center
6-OG-5C	20'	**A.W. Wolfendale:** The diffuse flux of extragalactic gamma rays

Lunch break

15:00 *Oral Session 3/A* *Room A* *Chair:* **M. Simon**

Galactic acceleration and propagation below 1 TeV (5/1)

5-OG-1HL	30'	**E. Berezhko:** Theory of particle acceleration in Supernova remnants: recent achievements
5-OG-2C	20'	**U. Heinbach:** Propagation of galactic cosmic rays under diffusive reacceleration
5-OG-3C	20'	**F.C. Jones:** On using the weighted slab method in studying the problem of cosmic-ray transport
5-OG-4C	15'	**M.A. Malkov:** Theory of ion injection at shock fronts

15:00 *Oral Session 3/B* *Room B* *Chair:* **A.D. Erlykin**

Around and above the "knee" (7/1)

7-OG-1HL	30'	**J. Wdowczyk:** Determination of primary cosmic ray composition from X-ray chamber data
7-OG-2HL	30'	**J.N. Stamenov:** Primary mass composition investigation at energies 10^4 - 10^7 GeV and selection of EAS at mountain altitudes
7-OG-3C	15'	**G. Auriemma:** Composition studies with underground detectors
7-OG-4C	15'	**K. Bernlöhr:** Muons in extensive air showers and the cosmic ray composition near the knee

16:30 *Tea and Coffee break*

TUESDAY, 30 AUGUST (Continued)

17:00 Oral Session 4/A Room A Chair: L. Drury

Galactic acceleration and propagation below 1 TeV (5/2)

5-OG-5HL	30'	**P. Spillantini:** Direct detection of p^+, p^-, e^+, e^-, muons, deuteron and He
5-OG-6C	10'	**W. Menn:** IMAX (Isotope Matter-Antimatter Experiment)
5-OG-7C	10'	**O. Reimer:** A measurement of light isotopes and antimatter with the IMAX-experiment
5-OG-8C	15'	**M. Simon:** ISOMAX: a baloon-borne instrument to study Beryllium and other light isotopes in the cosmic radiation
5-OG-9C	15'	**A.J. Keane:** Investigation of nuclear fragmentation in determining the spectrum of UHE cosmic rays from the Dublin–ESTEC experiment on LDEF
5-OG-10C	15'	**F. Jansen:** The ultra-heavy cosmic data from the Dublin–ESTEC experiment on LDEF satellite and a halo diffusion model for cosmic rays

17:00 Oral Session 4/B Room B Chair: J.N. Stamenov

Large detector systems and methodology (8/2)

8-LDS-6C	20'	**C. Forti:** Underground muon physics at MACRO–I
8-LDS-7C	10'	**E. Scapparone:** Underground muon physics at MACRO–II
8-LDS-8C	25'	**G. Navarra:** Study of EAS at $E_0 = 10^{14} - 10^{16}$ eV
8-LDS-9C	20'	**P. Galeotti:** 1992-1994 discussion of two year data obtained by LVD at Gran Sasso
8-LDS-10C	20'	**J. Procureur:** "Muon Eye" as the new EAS detector

Dinner break

20:00 Oral Session 5/A Room A Chair: L. Dorman

The Sun and its effects on the inner heliosphere (1/2)

1-SH-5C	15'	**J. Kopp:** Energetic ions from the October 1989 solar particle events
1-SH-6C	15'	**M.A. Shea:** A comment on the relationship between the location of solar active regions and the location of the Heliospheric current sheet
1-SH-7C	15'	**S. Fischer:** On an energetic particle flux variation inside a magnetic cloud
1-SH-8C	15'	**S. Sartori:** Cosmogenic nuclide production rates in meteorids and meteorites
1-SH-9C	15'	**G. Reitz:** Results of dosimetric measurements in space missions

20:00 Oral Session 5/B Room B Chair: G.B. Khristiansen

Large detector systems and methodology (8/3)

8-LDS-11C	15'	**P. Bernardini:** Upward-going muons in the MACRO detector
8-LDS-12C	15'	**M. Spurio:** Upward going stopping muons and ν_μ interactions in MACRO
8-LDS-13C	15'	**I.E. Sleptsov:** Yakutsk EAS array
8-LDS-14C	15'	**S.N. Karpov:** First results of the Baksan underground scintillation telescope in combination with EAS array "Andrychy"
8-LDS-15C	15'	**A.A. Petrukhin:** NEVOD - Neutrino water detector on the Earth's surface
8-LDS-16C	15'	**L.A. Kuzmichev:** Baikal neutrino experiment: present status and results

WEDNESDAY, 31 AUGUST

8:30 *Invited Session 5* *Room B* *Chair:* **A.W. Wolfendale**

INV-10	40'	**M.I. Panasyuk:** Energetic ions in cosmic rays
INV-11	40'	**J. Kóta:** Three–dimensional transport of cosmic rays in the inner Heliosphere
INV-12	40'	**A.E. Chudakov:** Primary CR mass composition from muon groups underground (Baksan data)

10:30 *Tea and Coffee break*

11:00 *Oral Session 6/A* *Room A* *Chair:* **M.I. Panasyuk**

Ulysses, 3D structure, anomalous component, modulation (2/2)

2-SH-4C	20'	**L.I. Dorman:** On the cosmic ray convection–diffusion and drift anisotropy in the interplanetary space
2-SH-5C	15'	**Z. Kobylinski:** Numerical models of galactic cosmic rays modulation in nonspherical heliosphere
2-SH-7C	20'	**J. Kóta:** Cosmic–ray transport at high energies: the limitations of diffusion approach
2-SH-8C	10'	**E.V. Kolomeets:** Additional particle fluxes in the upper Earth atmosphere due to anomalous M-group nuclei fluxes in the cosmic space and their change in time
2-SH-9C	10'	**E.V. Kolomeets:** 11–year variation of North–South anisotropy

11:00 *Oral Session 6/B* *Room B* *Chair:* **G. Navarra**

Large detector systems and methodology (8/4)

8-LDS-17HL	25'	**G.B. Khristiansen:** The EAS–1000 array
8-LDS-18C	20'	**H.J. Gils:** Status of the cosmic ray experiment KASCADE
8-LDS-19C	15'	**H.J. Simonis:** Muon counting with the KASCADE–array
8-LDS-20C	15'	**A.S. Lidvansky:** Angular resolution of EAS array used as a telescope in UHE gamma ray astronomy
8-LDS-21C	15'	**N. Müller:** MC simulation of atmospheric Cherenkov light for a system of 5 imaging Cherenkov telescopes

Lunch break

Excursion:

14:00 *Departure by coach to Veszprém*
16:00 *Departure by ship from Füred pier to Tihany*
17:30 *Organ concert in Tihany Abbey*
18:30 *Dinner and folklore program at Nemesvámos in "Betyár Csárda"*

THURSDAY, 1 SEPTEMBER

8:30 *Invited Session 6* *Room B* *Chair:* A.E. Chudakov

INV-13	40'	**A.W. Wolfendale:** Cosmic rays of the highest energies
INV-14	40'	**S. Nikolsky:** Spectrum break in primary CR or confinement violation at 10^{16} eV?
INV-15	40'	**H.V. Cane:** The evolution of interplanetary shocks and the relevance for particle acceleration

10:30 Tea and Coffee break

11:00 *Oral Session 7/A* *Room A* *Chair:* H.V. Cane

The Sun and its effects on the inner heliosphere (1/3)

1-SH-10HL	30'	**M.-B.Kallenrode:** Acceleration and propagation of energetic particles in the inner heliosphere
1-SH-11C	20'	**G. Wibberenz:** Different kinds of energetic particle events related to interplanetary shocks: influence of variable acceleration efficiencies and particle mean free paths
1-SH-12C	15'	**G. Wibberenz:** Multi-spacecraft studies of Forbush decreases, interplanetary structures, and bi-directional energetic particle distributions
1-SH-13C	25'	**E.O. Flückiger:** Open questions in the analysis and interpretation of neutron monitor data

11:00 *Oral Session 7/B* *Room B* *Chair:* S.I. Nikolsky

Around and above the "knee" (7/2)

7-OG-5HL	25'	**G.V. Kulikov:** The primary cosmic ray mass composition around the knee of the energy spaectrum
7-HE-6C	25'	**V.I. Yakovlev:** Long flying component and the problem of existence of so-called "knee" at around 10^{15} eV
7-HE-7C	15'	**J. Szabelski:** Verification of simulated EAS properties in Lódz EAS array
7-HE-8C	15'	**J. Procureur:** Selection of γ–showers Using the TTC–method
7-OG-9C	15'	**V.V. Alexeenko:** The anisotropy of cosmic ray flux at 10^{14} eV

Lunch break

15:00 *Oral Session 8/A* *Room A* *Chair:* E.O. Flückiger

CR variations, fluctuations, fractals (3)

3-SH-1HL	30'	**K. Kudela:** Fractal structure of cosmic ray intensity variations
3-SH-2HL	25'	**L.I. Dorman:** Search of cosmic ray forecast features for big Forbush–decreases
3-SH-3C	15'	**M.V. Alania:** A new classification of Forbush–decreases based on the energy spectrum changes of cosmic ray intensity variations
3-SH-4C	15'	**L. Shatashvili:** Variability of solar diurnal variation in connection with different manifestations of solar and geomagnetic activities

THURSDAY, 1 SEPTEMBER (Continued)

15:00 ***Oral Session 8/B*** ***Room B*** ***Chair:*** **J. Wdowczyk**

Prospects and results of accelerators and CR physics (4)

4-HE-1HL	30'	**J. Capdevielle:** Microscopic parton physics and high energy cosmic ray interactions
4-HE-2C	15'	**T.J. Thouw:** A look at the leading particle and inelasticity problem
4-HE-3C	15'	**T. Wibig:** Inelasticity in hadron-nucleus soft collisions in the geometrical two-chain model
4-HE-4C	20'	**L. del Peral:** Muon content of UHE air showers, discrimination method between electromagnetic and hadronic. Fit to analytical formulae
4-HE-5C	15'	**H.H. Mielke:** The hadron flux at sea level in the energy range 5 GeV to 10 TeV

16:30 *Tea and Coffee break*

17:00 *Poster Session*

20:00 *Banquet*

FRIDAY, 2 SEPTEMBER

8:30 ***Invited Session 7*** ***Room B*** ***Chair:*** **J.-N. Capdevielle**

INV-16	60'	**P. Jenni:** Physics prospects at LHC
INV-17	30'	**E.J. Fenyves:** High energy physics at the standard model and beyond
INV-18	30'	**W.D. Dau:** Results from e-p collisions in HERA. Relevance to cosmic rays

10:30 *Tea and Coffee break*

11:00 *Discussion & Conclusions*

Invited experts will present their views on progress achieved and future prospects in the various fields of research covered by the 14th ECRS, followed by general discussion.

12:30 *Closing Session*

Lunch break

14:00 The main session room (Room B) will be available for pre-organized special meetings and for informal discussion throughout the afternoon.

1. The Sun and its effects on the inner heliosphere

2. Ulysses, 3D structure, anomalous component, modulation

3. CR variations, fluctuations, fractals

4. Prospects and results of accelerators and CR physics

5. Galactic acceleration and propagation below 1 TeV

ABSTRACTS

INVITED PAPERS

INV-1

The Ulysses Mission: a voyage across the Poles of the Sun

K.-P. Wenzel
Space Science Department of ESA, ESTEC
Noordwijk, The Netherlands

Ulysses is the first space probe to explore the region of space above and below the poles of the Sun. Between June and October 1994 it will traverse the south polar region. Ulysses carries a complement of scientific instruments to characterise the heliospheric magnetic field, the solar wind plasma, the energetic particle environment and other inter- planetary phenomena along its trajectory. The payload also includes several cosmic ray sensors that measure properties of various particle species over a wide energy range.

The paper will present an overview of this exploratory mission and give highlights of results obtained so far.

INV-2

The high-latitude heliospheric magnetic field

André Balogh
The Blackett Laboratory
Imperial College, London, U.K.

The large scale geometry and the smaller scale characteristics of the heliospheric magnetic field are expected to be strong functions of heliolatitude. At high solar latitudes, the Parker model has predicted that the field lines are less wound than near the ecliptic. Furthermore, at least during solar minimum conditions when large polar coronal holes are expected to generate large scale, relatively steady fast solar wind flow, large scale energy and momentum transfer processes associated with Corotating Interaction Regions are expected to give way at high latitudes to wave fields more representative of coronal conditions close to the Sun. The Ulysses magnetic field investigation has confirmed the general validity of these expectations. Following the disappearance of the sector structure at 30^{o} heliolatitude, the heliospheric medium has been dominated by the fast solar wind flow from the southern polar coronal hole. Observations will be presented over a heliolatitude range from the ecliptic to over 70^{o} south, both of the large scale features of the magnetic field and its small scale characteristics. The variation of the characteristics of shock waves with heliolatitude will also be discussed, as well as observations of high latitude Coronal Mass Ejections.

INV-3

The Anomalous Component of Cosmic Rays: a Review and New Results from Sampex

B. Klecker

Max-Planck-Institut für Extraterrestrische Physik, D-85740 Garching, Germany

More than 20 years ago, in 1972, anomalous flux increases of helium and heavy ions were discovered during solar quiet times. These flux increases in the energy range < 50 MeV/nucleon showed peculiar elemental abundances and energy spectra, e.g. a C/O ratio < 0.1 around 10 MeV/nucleon, different from the abundances of solar energetic particles and galactic cosmic rays. Since then, the anomalous cosmic ray component (ACR) has been studied extensively and at least five elements have been found (He, N, O, Ne, Ar) whose energy spectra show significant increases above the quiet time solar and galactic energetic particle spectrum. There have been a number of models proposed to explain the ACR component. The presently most plausible theory for the origin of ACR ions identifies neutral interstellar gas as the source material. The neutral particles, after penetration into the inner heliosphere, are ionized by solar UV radiation and by charge exchange reactions with the solar wind protons. After ionization, the now singly charged ions are picked up by the interplanetary magnetic field and are then convected with the solar wind to the outer solar system. There, the ions are accelerated to high energies, possibly at the solar wind termination shock, and then propagate back into the inner heliosphere. A unique prediction of this model is that ACR ions should be singly ionized. In this paper the present status of experimental and theoretical results will be reviewed, including new results from SAMPEX and possible new constraints provided by correlative measurements at high and low latitudes during the upcoming solar pole passes of the ULYSSES spacecraft in 1994 and 1995 will be discussed.

INV-4

Properties of Solar Flare Acceleration from Multiwavelength Observations

E.L. Chupp[1], G. Trottet[2], H. Marschhäuser[3], M. Pick[2], P.P. Dunphy[1] and E. Rieger[3]

[1]University of New Hampshire
[2]Observatory of Paris – Meudon Section
[3]Max-Planck-Institute for Extraterrestrial Physics

We will review the salient properties of the flare associated transient neutral emissions by using meterwave, microwave, optical, X-ray, γ-ray and neutron observations. A study of several events shows that ion and electron acceleration is simultaneous and likely on subsecond time scales. Further, imaging observations by radio and optical telescopes, where available, coupled with simultaneous observations of the energetic neutral emissions illustrates the complexity of the overall acceleration scenario. Current observations support the view that a simple single loop geometry is not an appropriate model for major flares. Rather, strong spatial and temporal fragmentation of the acceleration and emission processes are involved. Realistic modeling of acceleration scenarios must include both ion and electron acceleration in coupled space and time evolution.

INV-5

AROUND AND ABOVE THE "KNEE"

A.D.Erlykin

P.N.Lebedev Physical Institute, Leninsky pr. 53, Moscow, Russia

Abstract

Latest results on cosmic rays around and above the "Knee" argue in favour of its composite structure. The most likely tendency for the mass composition is to grow heavier up to and through the knee energy and then again to become lighter beyond the knee.

INV-6

The HEGRA Project

W. Stamm

Institut für Kernphysik, Universität Kiel, Olshausenstr. 40-60, 24118 Kiel, Germany

INV-7

History of Solar Proton Prediction

M.A. Shea and D.F. Smart

Phillips Laboratory, Space Physics Division,
Geophysics Directorate, Bedford, MA, 01731, USA

Solar flare effects and related solar particle emissions can adversely affect the near-earth spatial environment. It is desirable to be able to predict when solar proton events will occur, how large they will be, and how long they will last. We examine the evolution of solar proton event prediction from the early 50's to the present time, the (unsuccessful) attempt to predict the distribution of events throughout the solar cycle, and the shift from solar flares to coronal mass ejections as a unique parameter necessary for solar proton events. Prompt, large magnitude, peak flux solar proton events are associated with solar activity on the western side of the solar disk; however, the long duration high fluence solar proton events are associated with major solar activity near the central meridian of the sun that generates powerful interplanetary shocks which intersect the earth.

INV-8

Ultra heavy Elements in the Cosmic Rays

L. O'C. Drury

Dublin Ist. for Advanced Studies, 5 Merrion sq., Dublin 2, Ireland

The theoretical significance and current observational status of ultraheavy element abundancies in the cosmic rays will be discussed.

INV-9

VHE Gamma-Ray Astrophysics

F.A. Aharonian

Max-Planck-Institut für Kernphysik, D-69029 Heidelberg, Germany

The talk highlights the motivation, the astrophysical background and the status of very high energy ($E \geq 100\,\mathrm{GeV}$) γ-ray astronomy in the era of the Compton GRO.

It is shown that the methods of ground-based γ-ray astronomy, in particular the imaging atmospheric Cherenkov technique, have reached a level which allows us to predict an energy threshold of detectors as low as 100 GeV, angular and energy resolution about 0.1°, and 25%, respectively, and a minimum detectable energy flux, $F_\gamma^{(min)} \approx 10^{-12}\,\mathrm{erg/cm^2 s}$. I discuss the possible scientific strategy for observations with emphasis on the following topics: (a) searching for acceleration sites of galactic cosmic rays; (b) probing the Universe with VHE γ-rays; (c) Episodic γ-ray events.

INV-10

Energetic Ions in Cosmic Rays

J.H. Adams[2], R. Beaujean[3], N.L. Grigorov[1], M.I. Panasyuk[1], A.J. Tylka[2]

[1] Skobeltsyn Institute of Nuclear Physics, Moscow State University
[2] Naval Research Laboratory, Washington
[3] Institute of Nuclear Physics, Kiel University

Ionic charge state measurements of cosmic rays are a relatively new, largely unexplored and potentially powerful source of information on the origins of the various components of cosmic radiation. In this paper, recent results on the ionic charge states of anomalous and solar cosmic rays will be reviewed. The insights obtained from considering these results will be discussed and prospects for future investigations of cosmic rays using this technique will be explored.

INV-11

Three-Dimensional Transport of Cosmic Rays in the Heliosphere

J. Kóta

University of Arizona, Tucson AZ 85721, U.S.A.

The 3-dimensional transport of galactic and anomalous cosmic rays in the heliosphere will be reviewed. We report on results from our numerical simulations including convection, anisotropic diffusion, drifts, and both adiabatic energy loss and shock acceleration. Our model-heliospere incorporates a wavy heliospheric current sheet, and Corotating Interaction Regions due to the variation of solar wind away from the current sheet. We are able to model the latitudinal as well as longitudinal variations, which latter appear as 26- and 13-day intensity waves. Emphasis will be put on the solar rotation induced variations. Our simulations for solar-wind speed, magnetic field and cosmic-ray variations seem in general form quite similar to observational findings. Quantitive predictions depend on a number of physical parameters as the parallel and perpendicular diffusion coefficients, as well as on assumptions made on the structure of the heliospheric current sheet and interplanetary magnetic field configuration.

INV-12

Primary CR mass composition from muon groups underground (Baksan data)

A.E. Chudakov

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Leninsky pr. 32a, Moscow, Russia

As suggested first in 1979 (Kyoto Conference, vol. 10, p. 192) muon groups underground can provide data on primary CR composition. Numerous experimental data obtained so far by Baksan Underground Scintillation Telescope and later also by some experiments at bigger depths were found to be compatible with the so-called "normal composition" (well established at 10 GeV/n) but at much higher energies (10 - 100 TeV/n). However, the recent analysis of the Baksan data demonstrated a specific difficulty arising mostly in the method when the energy of the primary nucleon is fixed by the simultaneous recording of high energy muon induced cascade. Limited statistics and difficulties in measuring very high multiplicities can lead to the underestimation of the average atomic number of primary CR. Thus at present some enrichment by heavy elements at 100 TeV/n can not be excluded.

INV-13

Cosmic Rays of the Highest Energies

A.W. Wolfendale

Physics Department, University of Durham, Durham DH1 3LE, UK

The origin of cosmic rays of the highest energies is one of the great problems of Physics. The lecture will assess the latest situation with respect to the mass spectrum and anisotropy of the particles and the clues as to their origin. The recent evidence for particles of energy significantly above 10^{20} eV from Utah and Akeno will be examined.

INV-14

Spectrum Break in Primary CR or Confinement Violation at 10^{16} eV?

S. Nikolsky

Lebedev Physical Institute, Leninsky pr. 53 Moscow 117924 Russia

One can explain the well-known break in the size spectrum of EAS at the electron number $\sim 10^6$ and a decrease of the height energy part of electrons and gamma-quanta in EAS cores at the electron number 10^7 by one of the two reasons: a break in the energy spectrum of the primary cosmic rays or the disappearance of fragmentation part in the multiple production of hadrons at the energy of primary protons $> 2 \times 10^4$ TeV.

The first, more simple explanation meets with the experimental conditions. The second one is too serious for the elementary particle physics.

INV-15

The Evolution of Interplanetary Shocks and the Relevance for Particle Acceleration

H. V. Cane

Code 661, Laboratory for High Energy Astrophysics NASA/GSFC, Greenbelt, MD 20771 USA

It is now widely accepted that interplanetary shocks initiated by coronal mass ejections play a dominant role in the generation of the vast majority of large energetic particle events. The observations at energies of 1 MeV and greater (from spacecraft at 0.3 AU to 1 AU), support this scenario. Our understanding of the details of the acceleration processes is far from complete however, with many unanswered questions. In order to address the aspects of a) what properties of a shock determine its efficiency for particle acceleration and b) how these properties change with radial distance from the Sun, the large-scale properties of shocks, as indicated by in situ and remote observations, will also be discussed.

INV-16

Physics Prospects at LHC

P. Jenni

CERN, PPE Division, CH-1211 Genève 23

The Large Hadron Collider (LHC) project at CERN will be reviewed, including the machine, the experimental programme, the main detector concepts and examples of the broad physics prospects.

INV-17

High Energy Physics at the Standard Model and Beyond

Ervin J. Fenyves

University of Texas at Dallas, USA

What is needed for the completion of the Standard Model: discovery and study of the top quark and the Higgs boson. Search for heavy gauge bosons, supersymmetric particles, compositeness of quarks and leptons, proton decay, and neutrino oscillations. Cosmic neutrinos and the solar neutrino problem.

INV-18

Results from ep-collisions in HERA Relevance to Cosmic Rays

W. Dieter Dau

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In the new storage ring collider HERA at DESY/Hamburg 820 GeV protons are smashed head on electrons of 27 GeV, giving a cms energy of about 300 GeV. This facility started successfully operating in late 1992 and opened a new domain in experimental particle physics.

The key issue in the experimental programme is to measure the partonic structure of elementary particles in a kinematic region of four-momentum transfer $5 < q^2 < 10^5$ GeV^2 and relative parton momentum of $10^{-4} < x < 1$. Two complementary experiments ZEUS and H1 have been set up.

In this talk first results will be presented on the structure of protons and photons and their cross-sections, which may be relevant for cosmic ray physics.

1 – THE SUN AND ITS EFFECTS ON THE INNER HELIOSPHERE

1-SH-1C

High Energy Processes in the June 1991 X-Class Flares

R. Ramaty

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We analyze, review and interpret the gamma ray, neutron and microwave/millimeter data for the 6 X-class flares, 1991 June 1, 4, 6, 9, 11 and 15, all of which resulted from the same active region. These flares produced the largest MeV gamma ray flux and 80 GHz flux density ever observed, as well as GeV gamma rays for 8 hours after the impulsive phase of a flare. We show evidence for the anisotropy of the bremsstrahlung gamma ray continuum based on the comparison of gamma ray and millimeter data, we examine the arguments for and against long term trapping based on nuclear line, high energy gamma ray and microwave data, we study the spectrum of the primary charged particles based on the combination of gamma ray and neutron data, and we show strong variations in the ratio of accelerated protons to electrons base on gamma ray, neutron and microwave data. We use data from all CGRO instruments, Phebus on GRANAT, neutron monitors on Mt Norikura, GAMMA-1, and radiometers at Nobeyama.

1-SH-2HL

Solar, Interplanetary, and Geomagnetic Phenomena in March 1991 and their Association with Spacecraft and Terrestrial Problems

D.F. Smart, M.A. Shea, E.O. Flückiger, and B. Sanahuja

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The solar activity that occurred on 22 and 23 March 1991 resulted in major interplanetary and geomagnetic disturbances. In spite of measurements at the earth, near Venus, and by the Ulysses spacecraft (at 2.48 AU) it is not possible to identify unambiguously the source of each perturbation. The intense solar particles caused SEU events in spacecraft semiconductors. A very powerful shock generated a third radiation belt as measured by the CRRES spacecraft and large geomagnetic disturbances. In addition the major oscillations in the cosmic ray intensity reflecting an unusual structure in the interplanetary medium have not yet been explained.

1-SH-3HL

Status Report on the Study of Cosmic Ray Particle Propagation in the Earth's Magnetosphere

E.O. Flückiger
Physikalisches Institut, Universität Bern
Sidlerstrasse 5, CH - 3012 Bern, Switzerland

The Earth's magnetic field, acting as a natural spectrometer for cosmic ray particles, is a "key instrument" in cosmic ray research. For the analysis and interpretation of cosmic ray measurements from satellite experiments and ground-based detectors, a detailed knowledge is required about the transport of cosmic rays in the near-Earth space and the effects of changes in the geomagnetic field.

The paper reviews the present-day state of the art in modelling the magnetospheric magnetic field for cosmic ray propagation studies based on particle trajectory calculations.

1-SH-4C

THE SOLAR PROTON EVENT OF THE 1990 MAY 24 SOLAR FLARE

R. Bütikofer, H. Debrunner, and E.O.Flückiger
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J.A. Lockwood
Space Science Center, University of New Hampshire, Durham, NH 03824

For the solar cosmic ray event on May 24, 1990 the solar proton differential energy spectrum near the Earth was determined using proton data from the cosmic ray telescope on IMP 8 for energies from ~40 MeV to 500 MeV and the records of the world wide network of neutron monitors for energies ≥500 MeV. The apparent source position deduced from the neutron monitor data with the asymptotic directions for this epoch was about 90° east of the direction of the nominal interplanetary magnetic field near the Earth. During the anisotropic phase of the event the solar proton spectrum near the Earth was then used to determine the evolution of the proton spectrum at the Sun as a function of time. The paper presents the method of analysis and discusses the results.

1-SH-5C

Energetic Ions from the October 1989 Solar Particle Events

J. Kopp[1], R. Beaujean[1], N.L. Grigorov[2], M.A. Kondratyeva[2], D.A. Zhuravlev[2], M.I. Panasyuk[2], Ch.A. Tretyakova[2] and S.P. Tretyakova[2]

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[2] Institute of Nuclear Physics, Moscow State University, Russia

During the solar particle events in October 1989 track detector stacks were flown on an three-axis stabilized Russian satellite in a 62.3 degree inclination orbit at 250 km altitude. Extremely high fluences of solar particles with nuclear charges equal to or greater than 6 were registered up to energies of a few hundred MeV/nuc. Integral energy spectra in the range 2-100 MeV/nuc and the elemental composition for nuclear charges Z=8-14 around 100 MeV/nuc are analysed. The distribution of particle arrival directions measured in two positions with different viewing directions is used to estimate an upper limit for the fraction of geomagnetically trapped particles in the measurement.

1-SH-6C

A Comment on the Relationship between the Location of Solar Active Regions and the Location of the Heliospheric Current Sheet

M.A. Shea, D.F. Smart, and S.W. Kahler

Geophysics Directorate, Phillips Laboratory, Bedford, MA, 01731, USA

In a study of the active solar regions that have been associated with major X-ray events and/or very energetic solar proton events, we have found that at least one third of the active regions are located more than 30 degrees from the heliospheric current sheet at 2.5 solar radii as indicated by the Stanford source surface maps. In some cases, notably active region 6659 associated with the June 1991 events, the solar active region is more than 50 degrees from the current sheet. Results of this preliminary study of active solar regions between 1976 and 1992 will be presented.

1-SH-7C

On an Energetic Particle Flux Variations Inside a Magnetic Cloud

M. Vandas[1], S. Fischer[1], and A. Geranios[2]

[1] Astronomical Institute, CAS, Prague
[2] Physics Department, Nuclear and Particle Physics Section, Athens University, Athens

Helios 1 observed a magnetic cloud on its closest distance from the Sun (0.3 AU) on 26 March 1976. During the passage of the cloud the flux of energetic particles generally decreases but this smooth decrease is interrupted by a sharp peak coinciding with a deep drop of the magnetic field magnitude. This behaviour is seen for protons and electrons in several energy bands (MeV to GeV for protons, keV to MeV for electrons). A possible explanation of this event can be obtained within the spherical model of magnetic clouds.

1-SH-8C

Cosmogenic Nuclide Production Rates in Meteoroids and Meteorites

S. Sartori

Department of Physics "G.Galilei", University of Padova, Italy

CR (cosmic-rays) irradiation at 1 AU has been simulated, by Monte Carlo and parton model, on artificial meteoroids, chondrites and iron-nickel, having spherical shapes and radii from 5 cm to 1 m. The Monte Carlo has been interfaced to GHEISHA/GEANT codes (GHEISHA means Gamma–Hadron–Electron–Interaction–SH(A)ower code), widely used at CERN by high-energy physics for calorimetric predictions, and suitable in thick targets for incident proton energies in the 10 MeV $\div$ 100 GeV interval, which contain the range of the dominant CR energies in the heliosphere at 1 AU. The resulting hadronic fluxes of secondary particles, neutrons, protons and π-mesons, have been evaluated in the meteoritic bulk. The depth profile of the cosmogenic production of ^{53}Mn from the stable isotopes of Fe and Ni has been predicted, in chondritic and iron-nickel matrices, as a function of a parameter representing the solar-modulation average-value on the irradiation period. The results on irradiated meteoroids have been compared with the experimental profiles in meteorites.

1-SH-9C

Results of dosimetric measurements in space missions

G. Reitz and R. Beaujean*

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Detector packages consisting of thermoluminescence detectors (TLD), nuclear emulsions and plastic track detectors were exposed on different spacecrafts in near earth orbits. Linear energy transfer (LET) spectra were obtained for LET values greater than 1GeV/cm from track measurements in cellulose nitrate CN-Daicel and CN-Kodak and Lexan polycarbonate foils. Evaluation of the emulsions yields data on interaction products, such as nuclear disintegration stars. TLDs allow to determine absorbed doses, delivered by cosmic rays and radiation belt particles and by neutrons. The data show a dependence on the solar modulation level, the orbit inclination and the amount of shielding thickness around the detectors.
The results are discussed and compared with calculations. Finally, the contribution of the single radiation components to the radiation load during space missions in near earth orbits is given.

1-SH-10HL

Acceleration and propagation of energetic particles in the inner heliosphere

M.-B. Kallenrode

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Energetic particle events observed in the inner heliosphere can originate in different sources, the largest events originate on the sun in flares and at shocks in front of coronal mass ejections (CMEs) and in interplanetary space in connection with traveling shocks. These different sources produce particle populations with different features as chemical composition, charge states and energy spectra revealing some information about the acceleration mechanisms. In particular, in large proton events accompanied by interplanetary shocks it can be shown that particles accelerated at the shock are the dominant species.

Energetic particles tell us also something about the structure of the interplanetary medium and the propagation conditions. Propagation in interplanetary space can be described by the scattering of particles at waves in the magnetic field. The close relation between transport and acceleration is most obvious in the particle events observed in connection with interplanetary shocks: here the strength of the scattering influences the acceleration efficiency and also has a strong influence on the general appearance of the particle event.

In this talk I will summarize the relevant observations on particle acceleration and propagation and discuss them in the framework of the basic theoretical concepts.

1-SH-11C

Different Kinds of Energetic Particle Events Related to Interplanetary Shocks: Influence of Variable Acceleration Efficiencies and Particle Mean Free Paths

M.-B. Kallenrode and G. Wibberenz

Inst. f. Kernphysik, University of Kiel, Otto-Hahn Platz 1, 24118 Kiel, Germany

We use a numerical code solving the equation of focused transport under consideration of an interplanetary shock as an outward propagating particle source to guesstimate the influence of the particle mean free path (mfp) and the acceleration efficiency of the shock as it propagates along the observer's magnetic field line. This method has the advantage to describe intensities and anisotropies simultaneously, it's disadvantage is the treatment of the shock as a black box. The particle mean free paths derived by this method are typically slightly larger than the mfps derived from the magnetic field spectra. In addition, the mfps are comparable to the ones found in previous studies of solar energetic particle events. The evolution of the shocks acceleration efficiency can be highly variable with efficiencies varying as r^{α} where α is between -2 and 2. Part of the change in acceleration efficiency might be due to the eastward movement of the footpoint of the observer's magnetic field line as the shock propagates outward. In other examples we find an extremely strong increase of acceleration efficiency as the shock propagates outward. These particle events show distinct features, in particular quasi-exponential particle increases and extremely weak proton spectra with spectral indices around -5.

1-SH-12C

Multi-Spacecraft Studies of Forbush Decreases, Interplanetary Structures, and Bi-Directional Energetic Particle Distributions

R. Hatzky[1], G. Wibberenz[1], and H.V. Cane[2]

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In previous studies (Cane et al. 1993, 1994) the two step decreases of high energy particles during Forbush effects were analysed. We use data from the University of Kiel instrument on Helios 1 and 2 to extend this study to the response of medium energy protons around 10 MeV to the arrival of the ejecta. We find several of the following effects,

a) an intensity depression which can be more pronounced than at high energies,
b) a net field-aligned preferential particle streaming,
c) a bi-directional anisotropy.

The results will be used to discuss the entry and propagation of this particle component - probably accelerated in the turbulent regions related to the interplanetary shock - into the ejecta material.

1-SH-13C

Open Questions in the Analysis and Interpretation of Neutron Monitor Data

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Unusual intensity-time variations in the counting rate of neutron monitors, such as the periodicities during the 1982 July 13/14 Forbush decrease and the unusual oscillatory modulation of galactic cosmic rays during the 1991 March 24 Forbush decrease, still lack a satisfactory explanation. The same is true for a number of "unidentified ground level events" (UGLEs) which have been observed at single neutron monitor stations, as well as for other effects discovered by the application of new data analysis techniques.

The paper gives an overview of the main classes of yet unexplained effects and their possible correlation with solar, interplanetary and magnetospheric phenomena.

1-SH-14P

The Longitudinal Distribution of Solar Flares Associated with Solar Proton Events at the Earth

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The heliolongitudinal distribution of solar flares associated with earth-observed solar proton events is a function of the particle measurement energy. For solar proton events containing fluxes with energies exceeding 1 GeV, we find a Gaussian distribution about the probable root of the Archimedean spiral path from the sun to the earth. As the energy threshold is lowered, the distribution evolves. For solar proton events containing large fluxes (>1000 per sqcm-sec-ster at energies exceeding 10 MeV), we find a composite of two Gaussian distributions; one around the probable root of the Archimedean spiral, and another centered about solar central meridian. For the >10 MeV solar proton events having a flux exceeding 10 per sqcm-sec-ster the distribution is no longer Gaussian.

1-SH-15C

STATISTICAL CHARACTERISTICS OF SOLAR COSMIC RAY EVENTS AND POSSIBLE ESCAPE MECHANISMS

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ABSTRACT

Statistical characteristics of solar cosmic ray events obtained on the base of three solar cycles satellite and ground observations are discussed in frame of models of energetic particles escaping. The problem of a flare particles escaping to the solar wind is very essential because this process defines observational properties of solar cosmic rays in really. During transition from a source in the solar corona(turbulent current sheet of a flare) to the solar wind an accelerated particles distort both spectrum and time dependence. Therefore an estimation of expected characteristics of solar cosmic rays events require understanding of their escaping mechanism.We try to investigate three types of particles ejection; a) directed run-away through open magnetic field into solar wind with possible effects of a plasma wave generation on the front of particle's beam and an effects of a particle-wave scattering and velocity's dispersion; b) accumulation of the accelerated particles in a magnetic trap produced by close magnetic field and following destabilization of this trap by fast MHD plasma instabilities; in a result of trap disruption with shock wave formation cosmic ray cloud escape in solar wind and propagate to the Earth with some additional delay time; c) as result of short-wave instabilities in cosmic ray trap the process of a slow anomaly diffusion to open magnetic lines is happened; this process formats the long-term low intensity component of solar cosmic rays with time of life much more then time of the flare in X-ray or optical range and connected with meter-decameter long-lived post flare radio bursts and storms. These processes are energy dependent and therefore essential distortion of the initial energy spectrum is expected.

1-SH-16C

ON THE INTERNATIONAL COSMIC RAY SERVICE

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ABSTRACT

The main idea of International Cosmic Ray Service (ICRS) is to combine satellite and space-probe cosmic ray, magnetic and plasma data with ground-based cosmic ray data (exchanged in real time) for obtaining continuous information on electromagnetic and radiation situation in the interplanetary space and Earth's magnetosphere.On the base of ICRS in the frame of the modern theory of solar cosmic ray generation and galactic cosmic ray propagation in the interplanetary space, according to special developed methods, it will be possible to organize a forecast service for prediction of great geomagnetic storms, big increases of radiation hazard and other phenomena, dangerous for people and technology in space and on the Earth.

DETECTOR SYSTEM FOR LOW ENERGY COSMIC IONS STUDY

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The design and construction of a low energy cosmic ions detector system has been performed. It is composed by a telescope and its amplification electronic. The detector is able to detect ions from Hydrogen to Iron in the energy range 1-50 MeV/nucleon. The amplification electronic was design with aerospace electronic components, in such a way that its low weight, dimensions and power consumption allows to ship aboard on satellite for cosmic ions detection. A system calibration in a heavy ion accelerator has been performed. The obtained results show a good charge and mass discrimination for the registered ions, just like good response when our amplification electronic has been used.

GEOPHYSICAL PHENOMENA PREDICTIONS BASED ON ARTIFICIAL NEURAL NETWORK (ANN) ELABORATION OF COSMIC RAY INTENSITY DATA.

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The appearances of magnetic storms, ionospheric disturbances, polar lights, and some orher geophysical phenomena are strongly connected with the high intensity solar particle fluxes comming across the Earth. From the other side the changes of these fluxes correlate well with the cosmic ray intensity variations.
These interconnections are taken in consideration investigating the possibilities for geomagnetic phenomena forcasts. The ANN method is applied on an wide complex of parallel measured long term heliospheric, ionospheric, meteorological, and cosmic ray data to obtain an "well trained" basic program.
A reliable magnetic storm predictability is expected if a world wide measured cosmic ray intensity data could be fast enogh introdused in this program.

1-SH-19P

LOW ENERGY COSMIC IONS IDENTIFICATION METHOD

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A method for discriminating cosmic ions that can be applied at low energies using ΔE–E is presented. The method is tested with a simple detector telescope, consisting of surface barrier silicon detectors. The results obtained irradiating the detector with ^{32}S ions at 795 MeV are presented and then compared with those obtained by applying the Seamster et al. algorithm.

1-SH-20P

Electron Acceleration by the Earth's Bow Shock

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Recently we have published (Astrophys. J. Suppl., 1994) an analytical solution for electron acceleration by a curved shock approximated by a cylinder or a sphere. However, real curved shocks (like the Earth's bow shock) are far from these ideal shapes and this matter affects electron acceleration. We present a method for calculation of electron acceleration by a curved shock wave of a general shape, discuss differences from the simple solution mentioned above, and show an application for the Earth's bow shock.

1-SH-21P

Solar Cosmic Rays and the Heliospheric Current Sheet

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Heliospheric current sheet (HCS) can be considered as a convenient channel to transfer the anisotropic beam of accelerated at the Sun particles to the Earth. At the same time, the HCS itself having a form of the "warped disk" often consists of a number of discontinuities which could be associated with so named Planar Magnetic Structures (PMS). The performed by us analysis of time-intensity profiles of relativistic solar protons at different neutron monitor stations along with data on the asymptotic directions of approach and the IMF seem to confirm the idea about linkage of the SCR with the HCS. The SCR anisotropy very often has the north-south direction correlating with the direction of the IMF vector strongly inclined to the ecliptic due to the HCS "warping". The stations looking along the anisotropy vector direction sometimes observe very sharp intensity variations of great amplitude which can be a manifestation of the Earth crossing of the multilayer planar magnetic structures containing highly collimated beams of the relativistic SCR.

1-SH-22P

Dependence of the Solar Cosmic Ray Energy Spectrum Registered on the Earth on Flare and Earth Heliocoordinates

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In the paper the results of research of the SCR energy spectra, registered during the solar flares in 1989-1991 are presented. On the basis of the world net neutron monitors stations experimental data calculations of the SCR energy spectra with $E > 10^9$ eV are shown. The calculations were carried out for the SCR maximum intensity and during the decrease, i.e. the SCR energy spectra changes in time were considered. The results of a model calculations showed that the most effective calculations met the experimental data are ones including high energy SCR drift in the interplanetary magnetic field (IMF), as well as a source(flare), a detector (the Earth) heliocoordinates and general IMF direction in present solar cycle.

It is displayed that the SCR energy spectra at the present moment in a wide energy range are not described by an exponent function with a single power. As a rule, in a maximum of intensity the SCR energy spectrum becomes softer with energy increase. After the intensity maximum the energy spectrum becomes harder depending on a source-detector location and the IMF direction. There are some cases when only the high energy particles are registered.

1-SH-23P
Energetic Charged Particles far Upstream of Comet Halley: Cometary or Solar Origin?

E.I. Daibog[1], M.A. Zeldovich[1], Yu.I. Logachev[1], V.G. Stolpovskii[1], G. Erdős[2], K. Kecskeméty[2], A.J. Somogyi[2], A. Varga[2]

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Measurement of low and medium energy (about 100 keV to 13 MeV) charged particle flux by the TÜNDE charged particle detector aboard VEGA-1 indicated the presence of ions of cometary origin as far as 7 million km from the comet. In this paper, based on high energy resolution data obtained during 2 hour fast telemetry seances 7, 2, and 1 day prior to closest flyby, an attempt is made to disentangle the components of cometary and solar origin.

1-SH-24P
Some Peculiarities of Solar Cosmic Ray Energy Spectra

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It is established that the energy spectra of solar cosmic ray (SCR) events at energies $\geq$ 30 MeV can adequately be described by power-law functions of particle rigidity on the basis of this conclusion SCR fluences have been analysed. It is shown that both the averaged spectral index and the standard deviation, which describes the spectral index fluctuations of individual events, depend on the event fluences. To describe the spectra at low energies ($<$ 30 MeV) the droop index is introduced. It is shown, that the mean value of the droop index and the standard deviation of droop indices of individual events depend both on the event fluence and the spectral index. On the basis of established quantitative characteristics of energetic spectra the probabilistic model of SCR events for the 1-1000 MeV energy interval is elaborated.

1-SH-25P
The Analytical Solution of Kinetic Equation for Solar Cosmic Rays

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Cosmic ray propagation in the interplanetary space on the basis of the Boltzmann kinetic equation is considered. The kinteric equation Green function for the isotropic scattering has been derived. The motion of scattering centers was not taken into account and the regular magnetic field was considered to be homogeneous. The weak scattering and diffusion approximations of the solutions obtained were performed

1-SH-26P

The Second Adiabatic Invariant Disturbance the Pitch-Angle Particle Diffusion in the Dipole Magnetic Field

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In the report the resonance interactions of magnetically trapped particles with low frequency electromagnetic waves are discussed. The conditions of stochastization of the particles, the change in the second adiabatic invariant as a result of such interaction, and the coefficient of velocity diffusion are determined.

1-SH-27P

Quasi-linear Model for Acceleration of the Solar Wind Protons by Travelling Interplanetary Shocks

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The nonstationary effects of the acceleration process of the solar wind protons by the travelling shocks is studied on the basis of a numerical method. The self-consistent Alfvén wave generation is studied in a quasi-linear approximation. The results of calculations are compared with the observational data.

1-SH-28P

Fine Structure of Solar Cosmic Ray Anisotropy from Data of Closely Spaced Neutron Monitor Stations in Apatity and Oulu

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The effects of the solar cosmic ray anisotropy from the data of closely spaced neutron monitor stations in Apatity and Oulu are considered. About 20 Ground Level Events (GLE) of the recent (22nd) and preceding (21st) solar cycles have been analysed. It is shown that both stations show equal intensities either during periods of SCR interplanetary isotropy or when asymptotic cones of these stations look in the opposite to the anisotropy axis direction. The difference in intensities between the stations may be caused by the anisotropy itself and it increases with the SCR spectrum softening due to the greater displacement of the Apatity and Oulu asymptotic cones at lower rigidities. On the other hand, the slight excess intensity at Oulu sometimes is observed which can be caused by the penumbra contribution or by the quasitrapped particles coming to the station by the drift-like way.

1-SH-29P

Anisotropy Effects in the GLE on September 29, 1989

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The effects of anisotropy of relativistic solar cosmic rays during the ground level event on September 29, 1989, are discussed on the basis of the hypothesis of the two-component injection of the particles at the Sun. The first component was manifested in the single maximum increase at the low latitude cosmic ray stations, high degree of anisotropy and very hard energy spectrum. The axis of the anisotropy in this increase was passing through the asymptotic cone of the Thule. The second component was indicated as a second maximum intensity at many high latitude stations. Very strong temporal variations during this second maximum can be described supposing that some large-scale magnetic structure was passing trough the Earth at this time and the anisotropy axis was not strongly changing its direction in space during all the event.

1-SH-30P

The Preliminary Results of Observation of Energetic Charged Particles and Gamma-Rays in the Experiment with the SCR Scientific Set of Instruments onboard the CORONAS-I Satellite

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Solar Cosmic Ray (SCR) set of instruments has been installed onboard CORONAS-I satellite which has been launched on 1994 March 2 on 500 km circular polar orbit. This set of instruments has been designed to observe solar flare emission, Earth radiation belts, geomagnetosphere structure and galactic cosmic rays. Preliminary results of the SCR electrons from 0.5 to 12 MeV, protons 1-200, >200 MeV, ions 1.5-19 MeV/n and gamma-rays 0.12-8.3 MeV, detection are given.

1-SH-31P

Bursts of Trapped Energetic Electrons

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Many experiments on satellite as "Molnia", "Prognoz", "Cosmos", "Intercosmos" show that energetic electron fluxes in the magnetosheath, magnetopause, geosynchronous orbit depend on the solar wind velocity. Connection has been found between bursts of energetic electrons with energy over 30 keV in the magnetosheath and outer Earth's radiation belt and the maxima of solar wind velocity. The time of transfer for energetic electrons from the boundaries of the magnetosphere to ionospheric altitudes is estimated on the basis of "Prognoz-4", "Intercosmos-19" and "Cosmos-900" satellite data. The delay in the appearance of maxima in electron bursts in the magnetosheath and outer radiation belt is several days relative to the maxima of solar wind velocity.

1-SH-32P

The Observation of Solar Flare Protons with Energy above 30 MeV in the Vicinity of Earth on board the "Mir" Station on 30 October 1991

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In experiment with magnetic spectrometer "Maria-2" on board orbital station "Mir" 30-31 October 1991 after solar flare class 3B the high energy proton fluxes of solar origin were registed. The energy spectrum of protons was measured. In the energy range 30 - 100 MeV it has the power law shape with spectral index $\approx$ 3. Near 300 MeV the spectrum cuts off rapidly. The comparison of experimental data with the results of satellite GOES-7 and experiment "Lulin" on board orbital station "Mir". The agreement is seen with interplanetary data of GOES-7.

1-SH-33P

Features of Electron and Ion Spectra at the Martian Bow Shock According to Phobos 2 Observations

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The dynamics of electron and ion fluxes at the vicinity of the Martian bow shock are studied on the basis of electron and ion spectra measured by the HARP and the TAUS spectrometers on board Phobos 2 in the its two elliptical orbits.

For two cases of the Mars's quasi-perpendicular bow shock the effects which occur in the electron-ion foreshock, and the processes of the electron acceleration and electron-ion heating behind the shock front are analyzed.

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2 – ULYSSES, 3D STRUCTURE, ANOMALOUS COMPONENT, MODULATION

2-SH-1HL

HIGH ENERGY COSMIC-RAY RESULTS FROM THE ULYSSES ASCENT TO THE SOLAR SOUTH POLE

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The high energy cosmic rays observed with ULYSSES vary with solar activity as well as with heliospheric position. Starting February 1992 ULYSSES climbes to high latitudes with the highest latitude in the south polar cap being reached mid September 1994. During the transition to solar minimum conditions the latitude dependence seems to be relaatively small. We will report on latitudinal gradients of quiet time nuclei and electron fluxes as well as on the latitude dependence of effects of corotating interaction regions.

2-SH-2HL

Low Energy Particle Observations in High Heliographic Latitudes: ULYSSES

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We present data from the EPAC instrument on board of the ULYSSES spacecraft and will discuss measurements of energetic charged ions in the energy range of 0.5 to 6 MeV/n obtained during 1992-1994 while ULYSSES was climbing in heliographic latitude. The most impressive feature during the early part of ascend was the repeated encounter with a forward-reverse shock pair associated with the interface of a fast solar wind stream with slow solar wind. When the S/C had left the streamer belt accelerated particles were still observed. Their origin will be discussed. Between the streams of accelerated we have observed a population of particles which, due to its composition has been identified as particles related to the anomalous component of cosmic rays.

2-SH-3C

Heavy Ion Measurement on LDEF

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Heavy ions with energies far below the cutoff energy required of fully stripped ions to reach the LDEF orbit were measured with plastic nuclear track detectors on the NASA satellite LDEF. This 3-axis stabilized satellite stayed in a 28.5 degree inclination orbit from April 1984 until January 1990 at a mean altitude of 476 km. The three detector stacks from Kiel, exposed at different locations on LDEF, provide an almost omnidirectional field of view. Energy spectra at 15-50 MeV/nuc and particle arrival directions were measured for ions with nuclear charge Z = 8-26 in the CR-39 foils of experiment M0002. The measured cylindrical geometry of the arrival directions and the steeply falling energy spectra are interpreted as evidence for a trapped component incident in the South Atlantic Anomaly. For a detailed study on oxygen and neon particles the analysis is now extended to the two Kodak cellulose nitrate stacks integrated in the experiment A0015 (DLR Koeln) which show a higher sensitivity compared to the CR-39 foils.

2-SH-4C

ON THE COSMIC RAY CONVECTION-DIFFUSION AND DRIFT ANISOTROPY IN THE INTERPLANETARY SPACE

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ABSTRACT

On the base of 25 years data of underground muon telescopes and ground based neutron supermonitors it was separated convection-diffusion and drift cosmic ray anisotropy. It was shown that the rigidity spectrums of these two types of cosmic ray anisotropy are sufficiently different. On the base of modern theory of cosmic ray modulation in the interplanetary space it gives the interpretation of obtained results and determined the cosmic rays transverse gradients .

Numerical models of galactic cosmic rays modulation in nonspherical heliosphere

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The features of the spatial distribution of galactic cosmic rays radial and heliolatitudinal gradients' have been investigated in terms of the anisotropic diffusion model taking into account the radial and heliolatitudinal dependence of Solar wind velocity and the influence of the interaction regions and merged interaction regions on the cosmic rays diffusion tensor .

It has been shown that in the different distances from the sun the significant changes of local radial and heliolatitudinal gradients arousing by the local conditions of the interplanetary space can be observed. The expected anisotropy of galactic cosmic rays in different points of the interplanetary space has been calculated.

Influence of Production of Anomalous Component Cosmic Rays on Position of the Solar Wind Termination Shock

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The formation of the solar wind termination shock in the presence of the galactic cosmic rays (GCR) and of the anomalous component cosmic rays (ACR) produced at the shock is described. The production efficiency e defined as the ratio of the solar wind energy flux that sinks to the cosmic rays energy to the total energy flux is taken into account. The appropriate modified Rankine-Hugoniot relations are formulated. The numerical solution of the 5 coupled nonlinear equations describing the 3-fluid solar wind model (background plasma, GCR, ACR) is presented. The termination shock radius is shown to increase with the increase of e. With the reasonable value of e (10-30%) the shock should be situated at r=80 AU and the precursor region is expected to occur at r>50 AU.

2-SH-7C

Cosmic-Ray Transport at High Energies: the Limitations of Diffusion Approach

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The diffusive description of cosmic-ray transport in the Heliosphere, which is generally accepted upto moderately high rigidities (50 - 100 GV, or so), should first become questionable then break down with the further increase of rigidity. We have developed a new approach that includes scattering but does not rely on the diffusion approximation. Instead of operating with diffusive streaming, the new scheme retains the full directional distribution. Our scheme yields a 3-dimensional force-field solution if certain special conditions are met. For the more general case, a numerical scheme is being developed. So far, we have considered some very simple scenarios with overly simplified geometries. The preliminary results we report on may give some insight into the more realistic cases, too.

2-SH-8C

Additional Particle Fluxes in Upper Earth Atmosphere due to Anomalous M-group Nuclei Fluxes in Cosmic Space and Their Change in Time

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In this report the experimental data of registration of an additional flux of common ionised cosmic radiation component of different levels of Earth atmosphere are published. This data were obtained by using a balloon nearby Almaty during the period of 1962-1993. We report about the occurrence of additional flux as high as $\approx 15\%$ at a depth less than 20 g/cm^2 while it becomes zero at the depth of 60-90 g/cm^2. Moreover, this flux is subject to changes from time to time.

According to the average data the additional flux has various amplitudes in different 11-year cycles, i.e. it depends on the direction of IMF and 22-year wave takes place. It is possible that the observed effect is connected with a drift of singly ionised atoms of O, N, and C in heliomagnetosphere. The scheme of a physical processes is the following: the partial ionisation of atoms of the M-nucleon group, acceleration of single ionised atoms in the heliomagnetosphere up to the energy of about several ten of MeV/nucleon, a relatively free entrance into the heliomagnetosphere at the expense of single ionised atoms - that is, for the singly ionised O^+, the rigidity for free passing to the point R=7 GV for protons must be about 0.86 GV.

2-SH-9C

11-year Variation of North-South Anisotropy

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2-SH-10P

Radial Cosmic Ray Gradients and Their Dependence on Particle Energy

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Measurements of cosmic radiation intensity at different altitudes in Earth's atmosphere at the high latitudes of the south and the north hemisphere permitted to determine N-S asymmetry of the cosmic rays for the period 1963-1992 years. N-S asymmetry variation amplitudes in time were determined. The frequency spectrum variations of the N-S asymmetry were calculated, where 1, 2, 11 and 22-year variations are particularly distinguished.

Using the Earth atmosphere as the energetic spectrometer for the calculation of the cosmic ray variation energy spectra, the dependence of the cosmic ray N-S asymmetry on energy of the primary particles were determined.

Using the data of the absolute value of the IMF and its components, the radial gradients of the cosmic ray density and their dependence on the energy and their change in time were calculated. Decreasing in magnitude of radial gradient of cosmic ray density with increase of the energy to 12-25 GeV and independence on the energy were noted in the some cases the increase in the interval 15-25 GeV were observed.

The possible interpretation of the observed effects is given.

2-SH-11P

Determination of Substance Element Composition by means of Cosmic Rays

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In this paper the possibility of determination of matter element composition in gas and liquid states as well as the solid surfaces by means of cosmic rays is considered. The results of research show that it is possible to determine up to 15 elements simultaneously. In the present time the quantity of simultaneously. In the present time the quantity of simultaneous element determination depends on the semiconductive and scintillative detectors quality, quantum photomultiplier sensitivity, electronics and amplitude analyser sensitivity and stability. Nowadays, in lab conditions a high accuracy and selection with very small element contents at the same time are reached. The same element identification is carried out simultaneously at two characteristic radiation levels atomic and nuclear. It's possible to determine with high accuracy the element composition of the Earth atmosphere, including gradient composition, polluted the Earth atmosphere, its surface and waters, salinity of soil and water.

Now the experiments are carried out in natural conditions.

2-SH-12P

Coherent Pulses in Diffusive Particle-Transport

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We present exact solutions to the diffusive transport of charged particles following impulsive injection for a simple model of scattering. A modified, two-parameter relaxation-time model is considered that simulates the low rate of scattering through perpendicular pitch-angle. Scattering is taken to be isotropic within each of the forward- and backward pointing hemispheres, respectively, but, at the same time, a reduced rate of scattering is assumed from one hemisphere to the other one. By applying a technique of Fourier- and Laplace-transform, the inverse transformation can be performed and exact solutions can be reached. By contrast with the first, and so far only exact solutions of Fedorov and Shakov, this wider class of solutions gives rise to coherent pulses to appear. The present work addresses omnidirectional densities for isotropic injection from an instantaneous and localized source. Our two-parameter scattering model will be compared with the more general anisotropic pitch-angle scattering mechanism.

2-SH-13P

ON THE GALACTIC COSMIC RAY NONLINEAR EFFECTS IN THE HELIOSPHERE

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ABSTRACT

It is shown that in the heliosphere for cosmic ray modulation and solar wind and shock waves propagation as well as for terminal shock wave formation the following cosmic ray nonlinear effects are expected to be important:

i. dynamics effects of galactic cosmic ray pressure in the radial direction on solar wind and interplanetary shock waves propagation,

ii. the influence of these dynamics effects on the formation of terminal shock wave and the character of the boundary of the heliosphere,

iii. transverse dynamics effects of galactic cosmic ray pressure on solar wind streams and interplanetary shock waves structure,

iv. Alfven turbulence generation by kinetic stream instability of non isotropic cosmic ray fluxes and its influence on cosmic ray propagation and modulation, on solar wind propagation and on geometry of the heliosphere.

2-SH-14P

MEDIUM- AND LONG-TERM SOLAR CYCLES AND COSMOGENIC ^{14}C

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ABSTRACT

Research of natural medium- and long-term radiocarbon concentration variations of the past has led to many conclusions on the manifestation of cyclicities, as well as the recurrence of characteristic patterns. Multiple evidence exist that the ~ 210-year radiocarbon cycle is caused by heliomagnetic modulation of the cosmic ray flux. An association between ~ 200-year type solar cycles recorded in tree-rings, in the historical records of sunspots and the variations of bristlecone pine widths, the thickness of varved sediments is real. The strongest feature in the radiocarbon record is long period of ~ 2000 year. Such a quasi-period has also been found in another dated natural archives of human and environmental history in time. Powerful manifestations of solar activity and climate warming epochs were taken place synchronously every ~ 2000 years during the end Pleistocene and the beginning of the Holocene.

2-SH-15P

The influence of the sun's differential rotation on the modulation of galactic cosmic rays

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The distribution of the density and the spatial gradients of cosmic rays in interplanetary space have been calculated in terms of anisotropic diffusion model taking into account the sun's differential rotation. It has been shown that in the such case due to reducing of the spirality of the interplanetary magnetic field the total modulation of galactic cosmic rays is less and the flux of cosmic rays especially from the regions of sun's poles changes non considerably. The effect of interplanetaty magnetic field's spirality in the anisotropy of galactic cosmic rays has been estimated.

2-SH-16P

North-South Asymmetry of the Daily Interplanetary Magnetic Field Spiral

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We have analyzed interplanetary magnetic field (IMF) data recorded by Earth-orbiting spacecraft near 1 AU during the 26-year period 1965-1990. This period covers solar activity cycles 20, 21 and the first half of cycle 22. The IMF azimuthal component is higher in magnitude than the radial IMF component north of the current sheet. The reverse of this effect is true south of the current sheet. This should produce an asymmetry in spiral angle with larger angle north of the current sheet than south of the current sheet. We have checked the existence of north-south asymmetry in spiral angle in three different criteria for defining the away and toward field days. All these criteria have proven the persistency of the spiral asymmetry. During our period of analysis the Earth spent more time north of the current sheet.

2-SH-17P

Nonlinear Model of Particle Acceleration by the Solar Wind Terminal Shock

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A possibility of the solar wind terminal shock to be fully modified by the accelerated particles backpressure is studied in the assumption that the majority of 'injected' particles comes from anomalous hydrogen. A spherically-symmetric model allows to study the dependence of the shock radius on the injected particles flux. Spectra of the other anomalous species are computed in assumption that the whole structure is formed by the protons.

2-SH-18P

Longitudinal and Latitudinal Asymmetry of Solar Activity and its Effect on the 27-day Cosmic Ray Variation

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We have examined the logitudinal asymmetry of sunspot area distribution during four solar cycles. The analysis showed that apart from the main maximum coinciding with the solar cycle maximum the longitudinal asymmetry features the second maximum during decline phase of solar cycle. Neutron monitor data were treated by means of 27-day Fourier analysis. It was shown that the amplitude of the 27-day cosmic ray intensity variation also displays two-maxima structure. The influence of the northern and the southern hemispheres of the Sun on the 27-day cosmic ray intensity variation at various periods of solar cycle was studied.

3 – COSMIC RAY VARIATIONS, FLUCTUATIONS, FRACTALS

3-SH-1HL

Fractal Structure of Cosmic Ray Intensity Variations

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An approach to the description of cosmic ray temporal variations based on the analysis of their scaling properties is presented. Two methods adopted from the study of interplanetary magnetic field (*Burlaga nad Klein, 1986; Burlaga 1991*) are used: (1) the scaling of the higher moments of the statistical distributions of cosmic ray intensity (CRI) and (2) the length of the histogram curve of the time profile of CRI for different averaging times. For neutron monitor energies two domains of scaling are examined for monofractality versus multifractality, namely at the times shorter than diurnal variation and at times longer than it. The comparison with the characteristics of the same type for CRI at higher energies is presented and the problem of presence of noise in the data is discussed, both with using the recent publications of other authors.

Burlaga, L.F., and L.W.Klein; J. Geophys. Res., 91, 347, 1986
Burlaga, L.F.; Geophys. Res. Lett., 18, 1651, 1991

3-SH-2HL

SEARCH OF COSMIC RAY FORECAST FEATURES FOR BIG FORBUSH-DECREASES

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Usual methods of big geomagnetic storm predictions based only on solar data may give a very low occurrence probability. The problem is that the majority of solar flares do not generate shock waves and magnetic clouds enough strong to produce geomagnetic storms. We try to find some additional forecast features by using world-network data of cosmic ray observations. We start to investigate many "historical" events in 1989-1991 by the global survey method. We investigate the behavior of isotropic cosmic ray intensity and of 3-dimentional vector of cosmic ray anisotropy before Forbush-decreases as well as results on cosmic ray scintillations on the base of 1-hour and 5-minute data. We find for some cases that 10-15 hours before Forbush - decreases the vector of cosmic ray anisotropy suddenly rotated from direction perpendicular to the Sun-Earth line to direction from the Sun and for some cases we found the change of scintillation spectrum.

3-SH-3C

A new classification of Forbush-decreases based on the energy spectrum changes of cosmic ray intensity variations

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A new classification of Forbush-decreases (FD) has been carried out according to the idea that temporal changes of the cosmic ray intensity variations energy spectrum exponent γ ($\delta D(R)/D(R) \propto R^{-\gamma}$, where R is of particle rigidity) during the minimum and recovery phases of FD is generally aroused by the solar wind velocity and Interplanetary field large-scale structure change. An investigation has been done based on the analysis of the neutron monitors data for the period of 1965-1991. It has been shown that for the great majority of FD (with the amplitudes more than 1,5-2% for the middle latitude cosmic ray stations) the cosmic ray variations energy spectrum in the phase of minimum intensity is soft and gradually becomes harder during the recovery phase, while the cases with the constant soft energy spectrum (γ>0.8-1.0) or constant hard spectrum (γ<0.4-0.5) are very rare. The power spectrum density of cosmic ray intensity fluctuations before FD and during the minimum and recovery phases show considerable changes as well. This must correspond to the significant changes of the interplanetary magnetic field large-scale structure during the FD in the vicinity behind forward shock. An interpretation of the change of the energy spectrum exponent γ and power spectrum density of cosmic ray intensity fluctuations during the FD in connection with the power spectrum density of the interplanetary magnetic field strength fluctuations has been given.

3-SH-4C

Variability of Solar Diurnal Variation in Connection with Different Manifestations of Solar and Geomagnetic Activities

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The method of the periodogram-correlation analysis with the purpose of study of the frequency-correlation connection of the amplitude variation of the cosmic ray (CR) diurnal harmonics with the parameters of solar and geomagnetic activity (SA and GA) has been used. It has been established by such analysis: 1. The high diurnal harmonics of cosmic rays correlate with the SA only at the frequency of the Sun rotation while the low harmonics also correlate at other frequencies. 2. The amplitudes of spikes of the correlation coefficients of CR diurnal harmonics with the geomagnetic activity exceeds significantly the amplitudes of the spikes of the correlation with solar activity. It is particularly noticed for the harmonics with m_2^2. 3. The disappearance of the spike (for the harmonic m_2^2) at the frequency of the Sun rotation is particularly seen.

Fluctuations of Interplanetary Magnetic Field

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Fluctuations of interplanetary magnetic field (IMF) in the time interval May-July 1985 using the Prognoz-10 satellite data were investigated. They were calculated cross-correlation spectra of IMF and spectra of autocorrelations of IMF in two frequency ranges (8.0×10^{-5} - 5.0×10^{-4}Hz and 5.0×10^{-4} - 4.0×10^{-3}Hz). These spectra were fitted with power law $B_o f^{-\nu}$, where f is frequency and ν is the spectral index. These spectral indices were investigated like function of average solar wind speed and plasma density. They were compared with predictions of the theoretical models of turbulence.

Variability of Cosmic Ray Fluctuation Characteristics

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We examined the time series of 5-minute records of neutron monitor (NM) data for the period 1991-1992 with special emphasis to SOLTIP intervals No. 1 - 3. Power spectrum density of Lomnický štít and Calgary NM for the 2 year interval and of few other stations for shorter periods were constructed on daily basis. The slopes (ν) of power spectra $P(f) \sim f^{-\nu}$ and their integrals (P_1,P_2) for two domains of temporal variations, namely those with characteristic time above (1) and below 1 hour (2), approximately corresponding to the lowest time at which IMF can affect the CR time variations (*Bazilevskaya and Struminsky, XXIII ICRC, Calgary, 3,p.743, 1993*), are computed. Temporal evolution of ν_i and P_i , their similarities on two stations and dependencies on K_p, D_{st} and on solar wind characteristics are summarized. In particular, possible redistribution of the IMF inhomogeneities deduced from the data in March and June 1991 and May 1992 , is discussed.

3-SH-7P

The features of the relationship of the cardiopathology tendency and cosmic ray and geomagnetic field disturbances

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The influence of cosmic ray and geomagnetic field disturbances on the features of the cardiopathology tendency based on the clinical observations of the patients generally suffering from myocardial and high pressure diseases (Tbilisi,Georgia) for the period 1991-1992 and statistical data of death from above mentioned diseases for a long period (14 years) has been investigated. It has been shown that: a) In the great majority of cases when the disturbances in cosmic ray intensity and geomagnetic field were observed simultaneously the increase of death was more than 3-4 σ (where σ is statistical deviation), b) In 1991-1992 when the disturbances were observed only in cosmic ray intensity (geomagnetic field was relatively quiet) the deterioration of the patients conditions (based on the clinical observations-343 and 271 patients in 1991 and in 1992 respectively) increase more than 4-σ with respect to the pre and post period of the disturbances, c) the autocorrelated and spectral analysis of the death data show the 5-7 days periodicity which corresponds to the social activity period (~ one week) and to the interplanetary magnetic field strength and to the different solar wind's parameters fluctuations. The reliable separation of the two effects in the statistical data of death and in the clinical data of patients conditions is the problem of future investigation.

3-SH-8P

Large scale structure changes of the interplanetary magnetic field fluctuations and the mechanism of 11-year cosmic ray modulation

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The features of the temporary changes of the galactic cosmic ray isotropic intensity variations' energy spectrum exponent γ ($\delta D(R)/D(R) \propto R^{\gamma}$, where R is the particle's rigidity) during the ascending and descending epochs for the different 11-year cycle of solar activity has been studied based on the data of the neutron monitors of the world network. For the fixed direction of the sun's global magnetic field, when the changes of solar wind velocity was not considerable, the significant 11-year variations of cosmic rays took place. It has been shown that the temporary changes of the galactic cosmic ray isotropic intensity variations' energy spectrum exponent γ is the important index , which gives possibility to understand the character of diffusion in different epochs of solar activity. In particular, a considerable rearrangement of the structure of the magnetic inhomogeneities of solar wind occurs during the 11-year cycle of solar activity. It is concluded that the large scale structure of solar wind which changes significantly during the 11-year cycle of solar activity is the fundamental reason of the 11-year variations of cosmic rays.

3-SH-9P

Investigation of Short Periodical Intensity Variation of Cosmic Rays

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The paper presents the experimental data results from the neutron monitor of Samarkand University during the solar variation occurring on 21 September 1989. The analysis of short periodical cosmic ray intensity variation is given. The spectra of cosmic ray velocity intensity are estimated and compared with the experimental data. It is known that in cosmic ray power spectrum the major part of the power is concentrated in low frequency and high frequency contribution to the total power is too small. So as to mark the variations with weak periods it is necessary to contract the frequency range by data filtration. This filtration is enough for the reduction of low frequency variations. It is also shown that the peak of the corresponding periodicity (40-100 min.) exceeding 95% is much more than the reliable level. Its existence is not the result of the reduction of low frequency part of the spectrum as we have observed its stability by different length filters. Thus we can point out the presence of stable variations with this frequency based on our investigation.

3-SH-10P

Investigation of Intensity Variation of Cosmic Rays in the Frequency Range of (0.03-0.5) 1/3 Hours

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Comparative analysis of a day cosmic ray variation and its spherical harmonics registered during the magnetic quiet and the magnetic storm days has been made. Changes of cosmic ray power spectra in the intervals of frequency (0.03-0.5) 1/3 hours during magnetic storm days are presented. The amplitude and the phase of the second cosmic ray harmonic was determined by the method of harmonic analysis. The monthly mean amplitude reaches $\approx 0.003\%$ and the phase is directed approximately at 3 (15) hours local time, and in the storm periods the amplitude of semidiurnal wave increase almost to one order and the phase anisotropy is shifted to later hours in agreement with the results of other works.

4 – PROSPECTS AND RESULTS OF ACCELERATORS AND COSMIC RAY PHYSICS

4-HE-1HL

Microscopic Parton Physics and High Energy Cosmic ray Interactions

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4-HE-2C

A look at the leading particle and inelasticity problem

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The VENUS model of hadronic collisions at high energies is used to study and discuss the problems of the leading particle and inelasticity. It is shown that in the framework of Gribov Regge Theory "string models", it doesn´t make much sense to use the leading particle formalismus, as all particles after the interaction are in a way secondary. Thereby defining a total inelasticity doesn´t make sense as well. Instead such quantities as the "electromagnetic", baryonic and "mesonic, non electromagnetic" inelasticities, which are unique, will be discussed. Values of these quantities at different interaction energies, for proton-N^{14} and pion-N^{14} interactions, will be presented.

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4-HE-3C

Inelasticity in Hadron-Nucleus Soft Collisions in the Geometrical Two-Chain Model

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Two features of great importance registered in experiments on hadron-nucleus collisions, are the decreased inelasticity and multiplicity in intranucleus collisions. In the paper we show that such a behaviour is a natural consequence of the Geometrical Two-Chain Model of multi-particle production processes. The quantitative comparison with the data is presented.

4-HE-4C

MUON CONTENT OF UHE AIR SHOWERS. DISCRIMINATION METHOD BETWEEN ELECTROMAGNETIC AND HADRONIC. FIT TO ANALYTIAL FORMULAE

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The muon component characteristics has been study by Monte Carlo simulation. It has been necessary to simplify the electromagnetic component simulation in order to have a significant number of events of 10 PeV primary energy. To do this, NKG parametrization of transverse development instead of simulation by EGS4 has been used. Muon component Longitudinal development has been calculated, and muon number with different energy cutoff 0.01, 1, 10 and 100 GeV. Muon and electron number ratio has been obtained. Discrimination criteria has been obtained for different primary particles. Gaisser and Sarkar parametrizations for muon lateral development has been checked.

4-HE-5C

The Hadron Flux at Sea Level in the Energy Range 5 GeV to 10 TeV

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With a prototype of the KASCADE hadron calorimeter vertical cosmic ray hadrons have been recorded. The all hadron flux was measured and the neutral hadron component has been determined. Both compare well with values obtained in other experiments. From the measurements of the unaccompanied hadron flux the total inelastic cross-sections for protons on air nuclei are deduced. The cross-sections agree well with values obtained by other authors. The transition curves for hadronic cascades in iron have been studied up to 5 TeV and are compared with Monte Carlo calculations with the FLUKA code.

4-HE-6P

Proton Spectrum Distortion in Thick Target Emulsion Chamber

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The spatial and energy distributions of gamma-quanta from proton interactions were simulated for a light material target of emulsion chamber (EC). It was shown, that in this case the 'threshold effect' distorting the proton spectrum covers the energy interval 5-7 times wider than in EC without any target. This may be one of the explanations of difference in the form of spectra obtained by EC with a target and without one.

4-HE-7P

The Properties of Hadronic System in Neutrino-Nuclei Interactions at the Energy 150 GeV

E632 Collaboration

presented by V. Murzin

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We have done a study of structure of hadronic system in neutrino charge current (CC) interaction in neutrino - neon collisions in 15-foot bubble chamber at the Fermilab Tevatron. The average energy of 2254 CC interactions was about 150 GeV. The bubble chamber was equipped with External Muon Identifier (EMI) to identify muons and isolate CC interactions. The efficiency of EMI was about 96%.

We studied the multiplicity of different particles (including "direct" leptons), their angular and momentum distribution, the portion of energy transferred to different kind of secondaries. The discussion of results will be done.

5 – GALACTIC ACCELERATION AND PROPAGATION BELOW 1 TEV

5-OG-1HL

Theory of Particle Acceleration in Supernova Remnants: Recent Achievements

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Recent theoretical results of the diffusive shock acceleration by supernova shock waves are discussed. A comparative analysis of different theoretical approachs is presented.It is concluded that simplified hydrodynamical models underestimate shock modification by CR backreaction and as consequence underestimate the efficiency of CR acceleration. Results of numerical studies of diffusive CR acceleration by supernova shocks (1,2) are presented and discussed.

1. E. Berezhko, V. Yelshin, L. Ksenofontov: Cosmic Ray Acceleration in Supernova Remnants, to be published.

2. E. Berezhko, H. Völk: Numerical Studies of Cosmic Ray Acceleration by Supernova Blast Waves in Stellar Winds, to be published.

5-OG-2C

Propagation of Galactic Cosmic Rays under Diffusive Reacceleration

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The propagation of cosmic rays in the galaxy is understood as a diffusive process where the magnetic field irregularities serve as scatter center. We here persue the idea that particles which interact with turbulent magnetic fields should naturally gain energy due to a stochastic second order Fermi type of acceleration. This link between diffusion and reacceleration is based on general physical principles and we can show that the cosmic ray data can be explained in this "Diffusive Reacceleration Model". As a consequence the escape length $\lambda_{esc}(E)$ which defines the particles path in the galaxy becomes a power law in rigidity with an exponent -1/3 which would indicate a Kolmogorow type spectrum of magnetic turbulences.

5-OG-3C

On Using the Weighted Slab Method in Studying the Problem of Cosmic-Ray Transport

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The weighted slab method has been used for many years as an approximation to the solution of the full equation for the interstellar propagation of cosmic-ray nuclei. The method has the advantage that the full propagation equation is separated into two independent equations, one for the nuclear physics, the slab model, and one for the astrophysics, the path length distribution or weights. This method is exact in the extreme relativistic regime where energy loss can be neglected but is known to be invalid when energy loss is not negligible. In this paper we describe two approaches to extending the utility of this technique into regimes where energy change cannot be neglected. In the first approach we have modified the weighted slab method so that, although it is still not exact, it gives the "best" approximation in a minnimization sense when energy loss can not be neglected. In this approximation the species dependent energy change term that operates on the path length distribution is "averaged" over the slab model solution for that particular energy and path length. In the second method we show that in diffusion models only exact solutions are possible with the weighted slab technique provided the diffusive mean free path is a separable function of energy per nucleon and position.

5-OG-4C

Theory of Ion Injection at Shock Fronts

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We have extended the theory of diffusive particle acceleration at parallel shocks to the low energy end where the spectrum must match the energy distribution of the thermal plasma. The standard acceleration theory ceases to work in this region due to the high anisotropy of the distribution function, and replaces the kinetics of the particles there by a crude parameterization which is commonly referred to as an "injection". We develop the formalism, which treats the thermal particles leaking from downstream and recrossing the shock front until they have gained energies acceptable for the standard description. This allows one to relate the injection rate to the hydrodynamic parameters of the subshock. In a quasilinear description the upstream pitch angle scattering of ions, not of electrons, is provided by the unstable growth of MHD waves due to the presence of the "warm beam" of ions, leaking from the downstream plasma.

5-OG-5HL

Direct Detection of p^+, p^-, e^+, e^-, Muons, Deuteron and He

P. Spillantini

After a brief introduction explaining the reasons of the revival of interest of Elementary Particle Physicists in Cosmic Ray research I will report on the results of the present balloon program in the study of the elementary particle component of CR (p^+, e^-, e^+, p^-, muons at different depths, and also deuteron and He) and the RIM (Russian-Italian Mission) program on Resource satellites.

The talk doesn't cover the isotopes (that is covered by a different collaboration), and will illustrate the results on elementary particle spectra obtained in the balloon flights of our and other collaborations, and finally will describe the characteristics and expected performance of the three flights foreseen for the RIM program; this program, begun in 1992, is now approved and funded by the INFN (Istituto di Fisica Nucleare) in Italy and by MEPI and VNIIEM in Moscow.

5-OG-6C

IMAX (Isotope Matter-Antimatter Experiment)

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We describe the Isotope Matter-Antimatter Experiment (IMAX), a balloon-borne magnetic rigidity spectrometer designed to measure cosmic ray antiprotons and light isotopes over an energy range from 100 MeV/nucleon to 4 GeV/nucleon. The instrument was succesfully flown from Lynn Lake, Manitoba, Canada on July 16-17,1992. Duration at float was 16 hours at an average altitude of 36 km, with an atmospheric overburden of less than 5 g/cm^2. We present an overall description of the instrument and its performance during flight.

5-OG-7C

A Measurement of Light Isotopes and Antimatter with the IMAX-Experiment

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The balloon-borne Isotope Matter-Antimatter Experiment (IMAX) was flown in Lynn Lake, Manitoba, Canada on July 16-17, 1992. It is a superconducting magnet in combination with a set of driftchambers and multi-wire proportional chambers. Particle mass is determined by means of a rigidity - velocity technique. Particle velocity was measured with a fast scintillator time-of-flight up to 1.8 GeV/amu and with large area aerogel Cherenkov counters from 2.5 to 4 GeV/amu. We report on preliminary results of measurements of the light isotopes (^{2}H,^{3}He,^{4}He) and antimatter.

5-OG-8C

ISOMAX : A Balloon-borne Instrument to Study Beryllium and Other Light Isotopes In the Cosmic Radiation

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The Isotope Magnet Experiment (ISOMAX), a balloon-borne magnetic rigidity spectrometer designed to measure the light isotopes of the cosmic radiation, is currently under construction. A major goal of the experiment is accurate measurement of the abundance of the radioactive isotope ^{10}Be up to relativistic energies (~ 4GeV/nucleon). The ISOMAX detector complement will include high-resolution drift chambers for trajectory determination, a time-of-flight system, and a Cherenkov detector utilizing silica aerogel radiators. ISOMAX is specially designed to take advantage of the emerging capability for long-duration balloon flights, with a two week dewar lifetime and low-power electronics.

5-OG-9C

Investigation of Nuclear Fragmentation in Determining the Spectrum of UHE Cosmic Rays from the Dublin-ESTEC experiment on LDEF

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The Dublin-ESTEC ultra heavy cosmic ray experiment which spent 69 months in earth orbit has collected more than 3000 ultra heavy nuclei in the range $Z \geq 70$. The experiment will provide the first statistically significant sample of cosmic ray actinide elements.
The present status of analysis of the charge spectrum will be presented.
Also to be discussed are the provisional results from the investigation into nuclear fragmentation in the detector of the actinide and sub-actinide nuclei.
The astrophysical significance of the data will be outlined.

5-OG-10C

The Ultra-heavy Cosmic Data From the DUBLIN-ESTEC Experiment on LDEF Satellite and a Halo Diffusion Model for Cosmic Rays

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The preliminary results for the ultra heavy cosmic ray component measured by the DUBLIN-ESTEC experiment on the LDEF satellite presented at this meeting has given "next generation" quality data, which will provide quantitative implications regarding the nature of cosmic ray sources, for which no entirely satisfactory answer has yet been given. These data are compared with a new source and propagation model for cosmic rays - the halo diffusion model. The halo diffusion model assumes the cosmic ray sources in the inner Galaxy and the propagation of cosmic rays from this region via the galactic halo of the Sun. Nearly all processes for energy and particle losses are considered. One primary result is the good agreement between the observed and calculated abundances of ultra heavy cosmic rays. Moreover, the observed galactic cosmic rays gradient can be explained by means of this realistic model and the calculated anti-proton flux is in the order of the measured one at the Earth.

5-OG-11P

On the Origin of High Energy Electrons and Positrons in Cosmic Rays

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The sharp increase of the positron content $R_+ = e^+/(e^- + e^+)$ in the cosmic ray (CR) electron flux at energies E $\geq$ 10 GeV, detected by several groups, is still regarded as an enigma, disturbing the cosmic ray community. So far only few models have been suggested, however they invoke rather exotic physics, e.g. annihilation of dark matter. Here we show that in fact the propagation of CR electrons being treated correctly, the 'enigma' disappears. The proper treatment of the CR electrons, namely, separation of contribution of one (or few) nearby ($R \sim$ 100 pc) and relatively young ($t \sim 10^5$ yr) source(s) from the contribution from distant ($R \geq 1$ kpc) sources explains the features of both the energy spectrum and charge composition of CR electrons observed from 100 MeV to $\geq$ 1 TeV energies. We claim that the nearby gamma-ray pulsar Geminga is, most probably, the source responsible for observed very high energy electrons.

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5-OG-12P

Cosmic Ray Anisotropy in Space

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The nature of cosmic ray anisotropy is investigated. It is shown that the observed anisotropy is mixed, in its production, by several mechanisms with different properties and different rigidity spectra. Some types of anisotropies reflect real cosmic ray fluxes and determine cosmic ray density distribution in space and energy balance (convection, anisotropic diffusion, neutral sheet drift, curvature drift, drift in inhomogeneous magnetic field, drift along shock wave front with energy change); other types give real anisotropy what can be measured, but don't give any cosmic ray flux (for example, the drift perpendicular to the magnetic field and the cosmic ray density gradient). These types of anisotropy are considered for the Galaxy and the Heliospere.

5-OG-13P

Synchrotron Radiation from Supernova Remnants

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We have developed the model for synchrotron radiation in the frequency range $10^9 \div 10^{10}$ Hz from supernova remnants, assuming that relativistic electrons are accelerated in the shock and that the magnetic field is the compressed interstellar magnetic field. The linear model gives a reasonable fit to the observations of SN 1006, whereas the fit Tycho's remnant requires the nonlinear approach.

5-OG-14P

Particle Escape from Plane Steady Shocks

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The question of adequacy of model particle escape through the upper cutoff energy E_{max} is considered for a plane steady shock fully modified by accelerated particles backpressure. On the basis of numerical study it is shown that the value of the energy flux through E_{max} is not determined by the plane steady shock boundary conditions, but formally is a free parameter. Determination of this parameter comes from treating the plane shock as being a part of a real object such as a spherical shock.

5-OG-15P

Kinetic Theory of Cosmic Ray Propagation with Memory

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We discuss the problem of cosmic ray propagation for small times. Our starting point is the kinetic equation in integral form

$$(\partial_t + \mathbf{v}\nabla_\mathbf{r})F_\mathbf{p}(\mathbf{r},t) = D_\alpha \int_0^t d\tau B_{\alpha\lambda}(v\tau) D_\lambda F_p(\mathbf{r},t),$$

where $\mathbf{D} = \frac{e}{c}[\mathbf{v}\frac{\partial}{\partial \mathbf{p}}]$, $\mathbf{v}$ is the velocity of particle with momentum $\mathbf{p}$, $B_{\alpha\lambda}$ is correlation tensor of random magnetic field. The solution of the equation for small angles of charged particle

scattering on random inhomogeneities of the magnetic field is obtained. If the correlation function of random magnetic field has the exponential shape this solution can be represented by the expression

$$F(z,\mathrm{r}_\perp,\vartheta,t)=\frac{3}{4}\frac{\theta(z)}{\pi^2}\left(\frac{R}{z}\right)^4\left\{\frac{1}{L_c^2}\delta(t-t_0)+\frac{2}{vL_c}\frac{d}{dt}\delta(t-t_0)+\right.$$
$$\left.+\frac{1}{v^2}\frac{d^2}{dt^2}\delta(t-t_0)\right\}e^{-(\frac{R}{z})^2\frac{\rho z}{L_c}}$$

where $\theta(z)$ - Heaviside function, $\rho=3\frac{\mathrm{r}_\perp^2}{z^2}-9\frac{\mathrm{r}_\perp}{z}\vartheta+7\vartheta^2$, $\mathrm{r}_\perp=\{x,y\}$, ϑ is a two-dimensional vector in the (x,y) plane, R is the mean Larmor radius of the charged particle, L_c is the correlation length of random magnetic field, $t_0=\mu\rho;\mu=\frac{z}{v}(1+\frac{R^2}{z^2})$.

5-OG-16P

Transport Equation of Cosmic Ray Propagation with Memory

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The transport equation describing cosmic ray propagation for small temporal intervals is obtained on the basis of the projection operator method. The kinetic equation for cosmic ray propagation

$$\frac{\partial f}{\partial t}=Lf, \tag{1}$$

with $L=L_1+L_0$, $L_1=\nu_s\frac{\partial}{\partial\partial x}(1-x^2)\partial\partial x$, $L_0=-vx\frac{\partial}{\partial z}$, ($\nu_s$ is the collision frequency) is reduced to the form

$$\frac{\partial^2 N(z,t)}{\partial t^2}-\hat{P}L_0^2N(z,t)=Q-2\nu_s\hat{P}L_0\int_0^t d\tau e^{L\tau}L_0N(z,t-\tau)+$$
$$+\hat{P}L_0\int_0^t d\tau e^{L\tau}(1-\hat{P})L_0^2N(z,t-\tau), \tag{2}$$

where $\hat{P}$ is the projection operator which acts on the arbitrary function of coordinates and momenta in accordance with the rule $\hat{P}f(z,\mathrm{p},t)=N(z,t)$. The approximation which neglects the last term in right hand side of equation (2) instantly reduces to the usual telegraphic equation with the diffusion wave velocity $u=v/\sqrt{3}$. The approximation which takes into account only the spatial derivatives of second order reduces to the modified telegraph equation with the diffusion wave velocity $u_m=v(1+a)/\sqrt{3}$, where $a\simeq 0.7$ (Earl 1974, 1992, 1993, Paul and Burger, 1993, Gombosi et al., 1993).

6 – GAMMA-RAY ASTROPHYSICS

6-OG-1HL

ON THE CRAB NEBULA VHE GAMMA-RAY FLUX.

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Abstract. The VHE gamma rays from the Crab Nebula were observed during October 93 using Crimean atmospheric Cerenkov flashes detector GT-48. It consists of 2 independent mounting which are 20 m apart. Besides 37-pixels multichannel imaging cameras GT-48 has detectors of ultraviolet Cerenkov radiation of the flashes. Using these 2 specific features give us possibility to detect the Crab Nebula gamma-ray flux at the confidence level, corresponding to 5 s.d. for the period egual to 8.5 hour observation on the source. It is shown that the efficiency for the detection of the VME gamma-ray increases approximately 3 times due to using double installation and UV detection. The value of the flux is approximately equal to 1.3×10^{-11} quanta cm^{-2} s^{-1}.

6-OG-2C

The Crab gamma ray spectrum revised in the range 3 to 15 TeV

THEMISTOCLE Collaboration

LPC (Collège de France-Paris, LPNHE (Un. Paris 6 -7), LAL (Orsay), LPNHE (Ecole Polytechnique-Palaiseau), Un. de Perpignan, CERN.

Abstract : In the THEMISTOCLE experiment, the relative energies of the gamma rays are reconstructed to an accuracy of 15% in the range 2 to 20 TeV, but the absolute energy scale depends mostly of the global cosmic ray trigger rate.

In order to best control and to cope with the systematics, an elaborate scheme has been developped, based on a more reliable simulation of both the nucleon-nucleon and nuclei-nuclei interactions, and introducing the weighting by the relative abundance of chemical species in the primary cosmics.

A revised version of the energy spectrum, in the range 2 to 10 TeV, of the Crab nebula will be presented. The new analysis lowers the gamma ray shower energies by an average 35% compared to the previous values.

Taking aventage of the increased statistics, some hints of the behavior of the Crab spectrum beyond 10 TeV will also be given.

6-OG-3C

The VHE Gamma-Ray Spectrum of the Crab Nebula

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We reexamine the inverse Compton spectrum of the Crab Nebula in the light of several recent observations at TeV energies. We show that the gamma-ray spectrum at these energies is dominated by inverse Compton scattering of infrared photons by high-energy electrons and positrons emitting synchrotron radiation in the X-ray range. These particles' synchrotron lifetimes are much shorter than the age of the Nebula, and their energy evolution is thus entirely determined by the magnetic field and flow structure in the inner part of the Nebula. We use Kennel and Coroniti's (1984) model of the Nebular flow to infer the energy spectrum of these high-energy particles, obtaining a harder spectrum than that assumed in previous calculations of the Crab's inverse-Compton spectrum. We show that the corresponding inverse-Compton spectrum agrees well with the available data in the TeV range, and has a gradually steepening spectral slope with increasing gamma-ray energy. We discuss the consequences of different magnetic field and flow structures in the inner Crab Nebula for the predicted VHE gamma-ray spectrum.

6-OG-4C

HIGH ENERGY GAMMA RAYS FROM THE GALACTIC CENTER

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At the center of our galaxy the compact and variable source Sgr A* appears to behave as a scaled-down version of an AGN. We discuss a model which bases on the evolution of monoenergetic electrons in Sgr A* and compare our results with available radio, X-ray, and gamma ray observations.

6-OG-5C

The Diffuse Flux of Extragalactic Gamma Rays

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Data from the EGRET Instrument on the Compton Gamma Ray Observatory and information on the column densities of Galactic gas have been used to enable a new detemination to be made of the extragalactic flux. The differential intensity of this component is given by

$$I(E) = 9.6 \times 10^{-7} E^{-\gamma} \mathrm{cm}^{-2}\mathrm{s}^{-1}\mathrm{GeV}^{-1}$$

where $\gamma = 2.11 \pm 0.05$ above 50 MeV.

An interpretation is given of the shape of the spectrum.

6-OG-6P

TOWARDS AN UNDERSTANDING OF DIFFUSE EMISSION FROM COSMIC RAYS IN SPIRAL GALAXIES

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Galactic cosmic rays can be observed in three ways: by their synchrotron radiation, by gamma ray observations, and by direct particles flux measurements. Here we give a progress report on the implications of a unifying model of cosmic ray transport, which is aimed to explain available data in all three regimes. The influence of secondary particles is explicitely discussed.

6-OG-7P

Cerenkov light emission in high energy cosmic nuclei showers.

THEMISTOCLE Collaboration
LPC (Collège de France-Paris, LPNHE (Un. Paris 6 -7), LAL (Orsay),
LPNHE (Ecole Polytechnique-Palaiseau), Un.de Perpignan, CERN.

Abstract : In the THEMISTOCLE experiment, the energy calibration of the gamma ray showers relies on the cosmic rays total trigger rate, hence it requires an elaborate simulation of the hadronic cosmic ray showers in the atmosphere.

A model for the production of Cerenkov light in high energy nuclei-nuclei interaction has been included in the simulation program. This model follows an ablation-evaporation scheme and is calibrated on GSI results. An impact parameter defines the number of nucleon-nucleon interactions, the remaining of the incident nuclei is evaporated and propagated.

The total yield, as a function of energy, and the radial distribution of Cerenkov light are simulated by Monte-Carlo at the altitude of the experiment (1650 m) for nuclei, from H to Fe, incident on Nitrogen.

6-OG-8P

SEARCH FOR γ EMISSION FROM MARKARIAN 421 WITH THE HEGRA AIR CERENKOV TELESCOPES

The HEGRA Collaboration (U.Hamburg, Kiel, Madrid, Wuppertal MPI Heidelberg, MPI Munich, Yerevan Physics Institute);
presented by S.M. Bradbury, MPI Munich

Abstract: Throughout spring 1994 the HEGRA collaboration searched for γ emission from the direction of the BL Lac object Markarian 421. Two air Cerenkov telescopes and the AIROBICC wide angle air Cerenkov detector were used to cover a search range from 1 to approximately 40 TeV. The two telescopes were operated primarily in a stereoscopic observation mode. Results of this campaign will be presented.

The scale height of cosmic ray electrons in the Galaxy

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([†] On leave from Yunnan University, Kunming, China.)

Abstract

The distribution of Inverse Compton gamma rays in the Galaxy has been determined from an analysis of the EGRET data from the Compton Gamma Ray Observatory. Use of the distribution of starlight energy density from the analysis of Chi et al. (1991) then leads to an estimate for the scale height of the initiating cosmic ray electrons.

Implications for the breakdown of the Leaky Box Model for cosmic ray propagation

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A.W. Wolfendale, Physics Department, University of Durham, Durham DH1 3LE, UK and
L. Zhang, Yunnan University, Kunming, China.

Abstract

The analysis of gamma ray data provides evidence for changes in the spectral shape and intensity of cosmic rays within 1 kpc of the sun. The Leaky Box Model is therefore invalid. A number of consequences follow, not least the explanation of the anomalous fluxes of positrons and anti protons in the primary cosmic ray beam.

6-OG-11P
Spectral variability of the Compton GRO BATSE data

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We present the result of the principal component analysis of the BATSE DISCSC data from the 2B catalog. Most of the spectral variability can be explained using an underlying spectrum which shape is fixed during the burst. This set of the spectra of the 2B catalog's bursts shows a very strong one-dimensional structure, so it could be well described with one parameter only. The correlation between this parameter and other burst parameters (length, V/V_{max}, distance, structure, etc.) is also discussed.

6-OG-12P
A New Technique for the 1 GeV - 50 GeV Gamma Ray Astrophysics

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6-OG-13P

Search for UHE Cosmic Rays from Crab Nebula by Tien Shan EAS Data

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A search for DC radiation with energy 10^{14} eV from the direction of Crab Nebula has been carried out on the base of Tien Shan EAS data, which were collected for two periods of observations: 1974-82 and 1985-90.

The selection of showers using applied parameters like shower size or age parameter does not give positive results. Only the choice of selection criteria using the relative number of muons or the energy of the hadron component shows some evidence of permanent flux from the region of Crab nebula at these energies.

6-OG-14P

Observation of the Crab Nebula at TeV Energies with Imaging Telescopes at La Palma

The HEGRA Collaboration
U. Hamburg, Kiel, Madrid, Wuppertal MPI Heidelberg, München,
Yerevan Physics Inst.
presented by H. Sander

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Between September 1992 and March 1994 the Crab Nebula was observed with two Cherenkov telescopes sited in the HEGRA detector array at La Palma. Using the imaging technique a signal of more than 5 sigma was detected. The observational results and the photon flux at TeV energies will be presented.

6-OG-15P

TeV Emission from Close Binaries

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It is commonly accepted that candidates for very high energy γ-ray sources are neutron stars, binary systems, black holes etc. Close binary systems containing a normal hot star and a neutron star (or a black hole) form an important class of very high energy γ-ray sources. Such systems are variable in any region of the electromagnetic spectrum and they enable us to study various stages of stellar evolution, accretion processes, mechanisms of particle acce'eration, etc. Phenomena connected with this class of very high energy γ-ray sources are discussed. Particular emphasis has been placed on the TeV energy region.

6-OG-16P

Diffuse Galactic Gamma-Ray Emission at Energies (100's GeV) $\leq$ E $\leq$(100's TeV)

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Cosmic ray (CR) spectra and composition got by direct measurments at E $\geq$ 100 TeV disagree with results got by external air shower (EAS) method (see Proc. 23 ICRC, vol. 2). Using results of direct measurments I show the breaks in the diffuse gamma-ray spectrum produced by CR particles of energies below the 'knee': its spectral index $\approx$ 2.75 at E < 100's GeV, $\approx$ 3.14-3.22 at (0.2-0.4) < E < (5-30) TeV, $\approx$ 2.51-2.65 at higher energies. The range of E is due to experimental uncertainties of results got by different groups. Using EAS data the gamma-spectrum has no breaks, its index $\approx$ 2.75 at 10 GeV < E < 100's TeV. Thus measurments of the 100's GeV - 100's TeV diffuse gamma-ray emission of the galactic plane and that of molecular clouds will improve the CR spectrum and composition at E $\geq$ 100 TeV. The measurements will be possible in gamma-ray experiments including GLAST (up to 0.3 TeV), GAMMA-400 (10 GeV - 1 TeV), CASA-MIA (> 100 TeV). This work was discussed at the seminars in my Institute and in Institute for Nuclear Research RAS.

7 – AROUND AND ABOVE THE "KNEE"

7-OG-1HL
Determination of Primary Cosmic Composition from X-Ray Chamber Data

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The mass composition of the primary cosmic rays at energies around 10^{16} - 10^{17} eV is critical for the understanding of the cosmic ray origin and propagation in the space. One of the sets of the experimental data on cosmic rays that can provide information on the mass composition at those energies is the data from X-ray emulsion chambers.

The results in general indicate that the showers in the atmosphere, initiated by primary cosmic rays, develop relatively fast. That fact is sometimes taken as an indication of primary heavies' dominance. Is should be, however, remembered that a similar effect is obtained if changes in the picture of high energy interactions is occurring. The need of some changes are also indicated by other data from cosmic rays.

Recently it has been pointed out that the mass of the primary particles can be determined from fractal analysis of the γ-ray families. That method is now applied to the experimental data, but so far no conclusive results have been obtained.

7-OG-2HL
Primary Mass Composition Investigation at Energies 10^4 - 10^7 GeV and Selection of EAS at Mountain Altitudes

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A new EAS selection method for observation levels $500 < x_0 < 700$ g cm^{-2} is developed, which gives the possibility for a practically unbiased estimation of the mass composition and energy spectrum of the primary cosmic radiation at energies 10^4 - 10^7 GeV.

Specific EAS experiments for observation level $500 < x_0 < 700$ g cm^{-2} is proposed in an attempt to calibrate the direct and indirect methods for primary mass composition study.

7-OG-3C

Composition Studies with Underground Detectors

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The study of the mass spectrum of primary cosmic rays between $10^{14} - 10^{16}$ eV, the so called "knee" region of spectrum, is of crucial importance, because in this region it is expected a transition from the diffuse interstellar shock (DIS) acceleration to a different mechanism. In this paper we shortly review the composition predicted by several models, in comparison with the experimental results obtained from underground detectors. The possibility that the determination of the mass of the primary from muon multiplicity or from penetration in the atmosphere could lead to different results is also discussed.

7-HE-4C

Muons in Extensive Air Showers and the Cosmic Ray Composition Near the Knee

CRT collaboration

presented by Konrad Bernlöhr

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With the Cosmic Ray Tracking (CRT) detectors installed at the site of the HEGRA air shower array on La Palma, Canary Islands, the arrival direction of individual secondary particles in air showers can be measured and muons can be distinguished from other particles. When operated together with the HEGRA array, the muon arrival direction and the muon numbers as a function of the distance from the shower core can be used for measuring the cosmic ray composition in the energy range 10^{14} to a few times 10^{15} eV. The measurement methods, the detector performance and initial results are presented.

7-OG-5HL

The Primary Cosmic Ray Mass Composition around the Knee of the Energy Spectrum

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Experimental muon number distributions in EAS obtained at Moscow State University are analysed to estimate the primary mass composition at energies before and after the knee. The mass composition before the knee is close to a normal one (as at $E_0 \sim 10^{12}$ eV), and after the knee experimental data agree with the assumption that normal composition becomes enriched slowly by heavy nuclei according to the Peters-Zatsepin diffusion model.

7-HE-6C

Difference of EAS Parameters Measured by Selection According to Shower Size or Flux of Cherenkov Light and the Problem of Energy Spectrum Bend Existence at 10^{15} eV

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112 scintillators and 10 Cherenkov counters were used to investigate EAS parameters which were measured according to shower size N or Cherenkov flux Q in the ring with radii 50 and 150 m. Results received: 1) excellent agreement of EAS size spectrum at $N > 1.3\times 10^6$ particles with previous data and Cherenkov light lateral distribution with calculations; 2) Big difference of shower parameters by different selection; 3) The great difference of Q/N values by selection according to N or Q that lead to bend absence up to energy $E = 5\times10^{16}$ eV when energy spectrum is measured according to the Q. 4) Indication on the sharp change N(Q) and G(Q) dependences at $E \approx 10^{16}$ eV, where G is ratio of photon densities at distances 50 and 150 meters from shower axis. Data received so as some results of other experiments indicates on the big role of unstable long flying component in the atmosphere at 10^{16} eV which can produce sharp irregularities.

7-HE-7C

Verification of Simulated EAS Properties in Lódz EAS array

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We present here a description of Extensive Air Shower (EAS) on the sea level as a function of the primary particle energy and atomic number. We give formulae for expected number of electrons and muons (two energy threshold 0.5 GeV and 5 GeV) at a given distance from the EAS core and a given size of the detector.

The description is verified by a comparison with EAS events observed in the Lodz EAS array. The possibility of determination of the primary spectrum and the mass composition is discussed.

7-HE-8C

Selection of γ-showers Using the TTC-method

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The only possibility to study primary γ-quanta with energy larger than 10^5 GeV is to select the corresponding showers generated in the earth atmosphere. Up to now, such a selection has been proposed based on the abnormal poorness in muons and hadrons of γ-EAS. We show that it is possible to determine a new selection criterium, independent of the behaviour of $\sigma_{\gamma-air}(E)$ at ultra-high energy, from the shapes of the muon production depth in γ and hadron showers. The distribution of the muon production depth is determined using the TTC-method. Then, among showers with given energy $\sim 10^6$ GeV, 95% of picked-up EAS are γ-showers and 5% generated by primary hadrons.

7-OG-9C

The Anisotropy of Cosmic ray Flux at 10^{14} eV

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7-OG-10P

The Main Properties of Long Flying Component of Cosmic Rays

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The long flying component (LFC) was first discovered in EAS cores (at energies of hadronic component $\approx$ 40 TeV) by helping of big ionization calorimeter and later conformed in special expe- riment with thick lead X-ray films chamber. We can to select EAS with LFC as it concentrates in central part of the cores that provides diffference in attenuation of central and peripheral parts of core. Energy dependence of hadronic component attenuation in the central part of EAS cores contained LFC demonstrates resonance-like behaviour that justifies that LFC contains unstable particles. Another resonance-like behaviour demonstrates the ratio of energy spectra of electron-nuclear cascades measured by ionization calorimeter without or with additional layer of carbon absorber. The presence of unstable LFC in EAS cores produces sharp changes in energy dependences of several parameters at $\approx 10^{16}$ eV, excess of EAS at big zenith angles and possibly the bend in EAS size spectrum.

7-HE-11P

High Energy Muon Production in Iron Generated EAS for Superposition and Fragmentation Models

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We present high energy muon production as results of M-C EAS development simulation. For simulating showers generated by iron nuclei we have used abrassion-evaporation approach to describe iron nuclei fragmentation (model presented by J.N. Capdevielle at this Symposium). We have observed considerably smaller muon production than that which would follow from the superposition model of iron generated EAS.

Our simulations were performed for CR primary particles of energies 10^3 - $10^{7.5}$ GeV/nuclei. Few muon energy thresholds were examined. Various distributions and correlations will be presented to justify advantages of fragmentation model.

7-HE-12P

The Peculiarity of the Extensive Air Showers Size Spectra at the Mountain Level and their Connection with the Primary Cosmic Ray Energy Spectrum at the Energies above 10^{17} eV

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The data of the primary cosmic ray energy spectrum at energies $E_0 \geq 2x10^{13}$ - $2x10^{18}$ eV are presented. The results were obtained on the base of Ne - size spectrum at Tien-Shan level (690 g/cm^2) in cosmic ray extensive air showers.

The Ne - size spectrum becomes flatter at $Ne > 5x10^8$ ($E_0 > 10^{18}$ eV), instead of $E_0 > 10^{19}$ expected from EAS data observed near sea level. At the same time our energy spectrum at lower energies ($E_0 < 2x10^{17}$ eV) is close to that obtained by the other arrays.

The difference would be connected with the changing of the cosmic rays interactions with the air nuclei. There fore E_0-spectrum on the base of the model used at the ~~lesser~~ smaller energies becomes disable for the ultra high energies.

7-HE-13P

Selection of EAS with Constant Energy in the Tien Shan Experiment

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A new EAS selection method is developed and applied for analysis of Tien Shan experimental data. It is shown that it is possible to select, at observation level 700 g cm^{-2}, showers with energies $10^5 - 10^7$ GeV with constant efficiency, i.e. not depending on the nature of the initiating primary particle.

The proposed method tested on the basis of muon and electron EAS components gives the basis for a practically unbiased estimation of the mass composition and energy spectrum of the primary cosmic radiation in the energy interval $10^5 - 10^7$ GeV using EAS experimental data obtained at mountain altitudes.

7-HE-14P

Longitudinal development of EAS at $3x10^{16}$-10^{17} eV Using the Results of Cerenkov Light Study

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Institute of Nuclear Physics, Moscow State University, Moscow 119899, Russia

The summary of the study of longitudinal development with the help of EAS Cerenkov light space-time structure recording at Yakutsk and Samarkand Arrays is introduced.

The results on the EAS maximum depth distribution and depth dependence on the primary energy are obtained. The shape of the mean cascade curve at the depth of more than 940 g/cm^2 is measured. The inelastic cross section of p-air interaction is estimated.

8 – LARGE DETECTOR SYSTEMS AND METHODOLOGY

8-LDS-1HL

The Wide Angle Air Cerenkov Telecope AIROBICC, A Prototype for a Future High Sensitivity, Low Threshold Cosmic ray Detector

The HEGRA collaboration
presented by E. Lorenz
MPI München

AIROBICC is a novel wide angle air cerenkov detector and part of the HEGRA cosmic ray detector complex. Its detection principle will be described and performance parameters like angular and energy resolution, gamma/hadron separation power and threshold will be given. The current performance allows us to make reliable predictions for a future high performance detector with an energy threshold between 1-3 TeV, excellent angular and energy resolution, high gamma/hadron separation power and large angular acceptance.

8-LDS-2C

FIRST RESULTS FROM OBSERVATIONS WITH THE WIDE ANGLE AIR CERENKOV DETECTOR AIROBICC IN COMBINATION WITH THE HEGRA ARRAY

The HEGRA Collaboration (U.Hamburg, Kiel, Madrid, Wuppertal MPI Heidelberg, MPI Munich, Yerevan Physics Institute);
presented by E. Lorenz, MPI Munich

Abstract: AIROBICC is a novel wide angle air Cerenkov detector covering an area of 35 000 m^2; it is part of the HEGRA cosmic ray detector complex on La Palma. First results from cosmic ray studies above 25 TeV primary energy will be given. We will present results from a point source search, an upper limit for isotropic gamma radiation around 80 TeV (for a search of topological defects) and also from a first attempt to determine a coarse chemical composition of cosmic rays above 300 TeV.

8-LDS-3C

PERFORMANCE OF THE HEGRA AIR CERENKOV TELESCOPE SYSTEM

The HEGRA Collaboration (U.Hamburg, Kiel, Madrid, Wuppertal MPI Heidelberg, MPI Munich, Yerevan Physics Institute); presented by R. Mirzoyan, U. Madrid and MPI Munich

Abstract: The HEGRA collaboration is constructing a system of five air Cerenkov telescopes within the HEGRA cosmic ray detector complex on La Palma (28.8^0 N, 17.7^0 W, 2220 m asl). The first two telescopes have been running in the stereoscopic observation mode since 1993. The performance of the current two telescope system and that expected from the five telescope arrangement will be presented. Emphasis is laid on the γ/hadron separation power of the stereoscopic observation mode.

8-LDS-4C

Monte Carlo Simulation of the HEGRA Cosmic Ray Detector Performance

HEGRA collaboration
presented by F. Arqueros

Universidad Complutense, Madrid, Spain

Detector simulation of the scintillator and wide-angle air Čerenkov (AIROBICC) arrays of the HEGRA experiment is presented. Predicted values of the angular resolution will be compared with experimental data. Shower size can be reconstructed from the scintillator signals with an error ranging from 10% to 45%. The measurement of the Čerenkov light intensity at 90 m from the shower core provides an accurate determination of the primary energy. The AIROBICC energy threshold for γ-rays is significantly lower than that of hadrons. On the other hand its angular resolution is about 0.2 degrees. These features together with the efficient γ/hadron separation achieved by the wide-angle Čerenkov technique (see contributed paper) make the AIROBICC array a powerful tool for γ-ray astronomy.

8-LDS-5C

The CAT project in VHE γ-ray Astronomy

French National Institutions (IN_2P_3 - CNRS, CEA, Univ. Perpignan), CERN, Dublin, Prague, Torino, Purdue Collaboration.

presented by B. Degrange, LPNHE École Polytechnique and IN_2P_3/CNRS, France

A new Cherenkov imaging telescope will be installed on the site of the former solar plant "Thémis" in the french Pyrénées, where two sets of Cherenkov detectors, ASGAT and THEMISTOCLE, using the wave-front sampling technique, are presently operated. The new imaging telescope, equipped with a very high definition camera (500 pixels, 2 mrad spacing) should have an energy threshold of about 180 GeV. The project, named "Cherenkov Array at Thémis" (CAT), has been approved and funded. The new detector is expected to take data at the beginning of 1996.

8-LDS-6C

Underground Muon Physics at MACRO - I

The MACRO Collaboration

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Bartol: J. Petrakis

Bologna: S. Cecchini[1], H. Dekhissi[2], G. Giacomelli, G. Mandrioli, A. Margiotta-Neri, P. Matteuzzi, L. Patrizii, B. Pavesi, E. Scapparone, P. Serra Lugaresi, M. Spurio, E. Vilela

Boston: S. Ahlen, J.T. Hong, E. Kearns, G. Ludlam, A. Marin, C. Okada, J.L. Stone, L.R. Sulak, W. Worstell

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Drexel: C. Lane, M. Mittelbrunn, R. Steinberg, J. Steele

Frascati: G. Battistoni[4], H. Bilokon, C. Bloise, M. Carboni, V. Chiarella, C. Forti, A. Grillo, E. Iarocci[5], A. Marini, V. Patera[5], F. Ronga, L. Satta[5], A. Sciubba[5], M. Spinetti, V. Valente

Gran Sasso: R. Antolini, C. Gustavino, S. Parlati, J. Reynoldson, S.P. Mikheyev[10]

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Lecce: P. Bernardini, G. Mancarella, D. Martello, O. Palamara, S. Petrera, P. Pistilli, A. Surdo

Michigan: R. Baker, S. Coutu, E. Diehl, K. Hanson, D. Levin, M. Longo, G. Tarlè

Napoli: M. Ambrosio, G.C. Barbarino, D. Campana, F. Guarino, G. Osteria

Pisa: A. Baldini, C. Bemporad, F. Cei[7], G. Giannini [8], M. Grassi, D. Nicolò[7], R. Pazzi

Roma: G. Auriemma[6], S. Bussino, A. Corona, M. DeVincenzi[9], E. Lamanna, P. Lipari, C. Satriano[6], M. Severi

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Texas A&M: Y. Lu, A. Sanzgiri, R. Webb

Torino: V. Bisi, P. Giubellino, A. Marzari Chiesa, M. Masera, M. Monteno, L. Ramello, M. Sitta

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presented by C. Forti

INFN of Frascati

Recent MACRO studies of underground muon data were obtained with the completed lower MACRO structure at the Gran Sasso National Laboratory. New results were obtained for:

a) flux and overburden studies
b) ultra high energy cosmic ray composition analysis
c) investigations into the lateral distribution of underground muon tracks within multiple muon bundles.

These studies are also relevant to our understanding and Monte Carlo modelling of cosmic ray shower development.

8-LDS-7C

Underground Muon Physics at MACRO - II

The MACRO Collaboration
presented by E. Scapparone

INFN and University of Bologna

Multiple muon events collected with the lower structure of the MACRO detector to allow to investigate cosmic ray hadronic interactions in the atmosphere and muon interactions in the rock.

The distribution of spatial and angular separation in multiple muon events is sensitive to the distance between the primary interaction point and the muon detection point as well as to the transverse momentum distribution of the parent hadrons. It also provides a measure of the effects of muon interactions on the rock overburden.

The good MACRO time resolution allows a precise measurement of the muon bundle time structure. The measurement of relative delays between muons in the same bundle can be used to search for heavy particles via their delayed muon arrival signature.

8-LDS-8C

Study of EAS at $E_0 = 10^{14}$ - 10^{16} eV

The EAS-TOP Collaboration
presented by G. Navarra

Dipartimento di Fisica dell' Univ. di Torino and INFN, Torino 10125 Italy

We discuss some results of the EAS-TOP experiment on

- gamma-ray astronomy
- anisotropies
- primary spectrum and composition

concerning the physics of the e.m. and of the muon detector are presented. Some results obtained with the hadron and Cerenkov detectors are also discussed.

8-LDS-9C

1992 - 1994 Discussion of Two Year Data Obtained by LVD at Gran Sasso

LVD Collaboration
presented by P. Galeotti

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The Large Volume Detector (LVD) in the Gran Sasso Laboratory is a neutrino telescope primarily designed to study Galactic Supernova Collapses. The LVD consists of a large volume of liquid scintillator interleaved with limited streamer tubes in a compact geometry.

The detector has a modular structure composed of 190 identical modules arranged in 5 towers. Each module has 8 scintillator counters surrounded by a l shaped tracking system. The total mass in the final configuration is 1840 tons of scintillator and the dimensions are 40x12x13 cubic meters.

Presently the first tower and one half of the second tower, corresponding to 560 tons of liquid scintillator, are taking data with an energy threshold of about 5 MeV. The scintillator system of the detector is being used to detect neutrinos and antineutrinos through elastic scattering and inverse beta decay reactions. The tracking system provides the reconstruction of charged particles tracks.

The first experimental results obtained in two years of data taking are here discussed.

8-LDS-10C

"MUON EYE" AS THE NEW EAS DETECTOR

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Abstract

Principles of a new EAS detector are discussed. It is based on the so called TTC (time-track complementarity) method, which implies the simultaneous measurement of incidence angles and arrival times of EAS muons. By means of just these measurements and using a single muon detector, the "Muon Eye", it is principally possible to locate EAS axis. The method of such a location and accuracy estimates are presented. The latter have been obtained by simulations. The duty cycle and the acceptance of even single "Muon Eye" have been shown to be rather large. Principles of the axis location and the possible advantage of using three or more "Muon Eyes" are discussed. Accuracy estimates for these "Muon Eye Net" arrays are also presented.

8-LDS-11C

Upward-Going Muons in the MACRO Detector

The MACRO Collaboration
presented by P. Bernardini

INFN and University of Lecce

About 5 million muon events have been collected with the lower part of the MACRO apparatus, during 30 and 6 months of operation with 1 and 6 supermodules, respectively. The data have been analyzed looking for upward-going muons coming from atmospheric neutrino interactions in the rock below the apparatus. A rejection factor of $\sim 1.5 \times 10^{-6}$ is necessary in order to separate the neutrino signal from downward-going muons. Tracks from the streamer tubes and time information from the scintillation counters have been used to remove background. The complete data sample (including downward-going muons) has been studied to check the acceptance and efficiency of the detector for upward-going muon events.

The total number and the zenith angular distribution of upward-going muons detected in the measurement period are presented and compared with the results of a full Monte Carlo simulation based on the Bartol atmospheric neutrino flux.

A search has been also performed for astrophysical point sources.

8-LDS-12C

Upward going stopping muons and ν_μ interactions in MACRO

The MACRO Collaboration
presented by M. Spurio

INFN and University of Bologna

The MACRO detector at the Gran Sasso laboratory is instrumented for high energy neutrino physics and astrophysics through the detection of muons induced by neutrino interactions. Upward going muons with momentum $0.1 < \mathbf{p}_\mu < 1\ GeV$ are stopped by the detector, and $\nu_\mu + N \rightarrow \mu + X$ reactions inside the apparatus can be detected if $\mathbf{p}_\mu > 100\ MeV$.

We present the first results of the search for upward going stopping muons and downward going muons generated by ν_μ interactions in the apparatus, during the data tacking period from Dec. 92 to Jun. 93, and the comparison with a Monte Carlo.

The main background source is due to inelastic downward going muon interactions in the concrete below the apparatus, with an upward going secondary charged pion. We found that the fraction of downgoing muons producing an upgoing secondary charged track is $\sim 1.3\ 10^{-5}$.

8-LDS-13C

Yakutsk EAS Array

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8-LDS-14C

First Results of the Baksan Underground Scintillation Telescope in Combination with EAS Array "Andrychy"

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At the end of 1993 the EAS array "Andrychy" was put in operation above the Baksan Underground Scintillation Telescope (BUST) in coincidence with the underground detector. The counting rate of these coincidences is 0.1/s. The multiplicity spectra of muons recorded by BUST for several primary energies determined by "Andrychy" are represented.

8-LDS-15C

NEVOD - Neutrino Water Detector on the Earth's Surface

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Cherenkov water detector on the Earth's surface for investigations of cosmic ray muons and neutrinos with a volume 2000 cubic meters is described. In this volume, the spatial lattice of quasispherical modules which can detect the Cherenkov light from any direction is placed. Each quasispherical module consists of six PMTs with flat photocathodes directed along the coordinate axes. This configuration allows to determine the direction of Cherenkov light. Preliminary experimental results on the detection of various events with the first part of the detector are discussed. The possibility and conditions of the separation of up-ward and down-ward going muons are analysed.

8-LDS-16C

BAIKAL Neutrino Experiment: Present Status and Results

The BAIKAL Collaboration
presented by L. Kuzmichev

Since April 13th, 1993 the underwater Cherenkov telescope NT-36, consisting of 36 photomultipliers attached to 3 strings, is operated in the lake Baikal. We describe this first stationary deep underwater array and present results from the first year of operation.

8-LDS-17HL

The EAS-1000 Array

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We discuss the main scientific problems of the EAS-1000 array, which will be solved on the base of contemporary experimental and theoretical achievements. These problems concern both the astrophysics (primary particles with energy greater than 10^{20} eV, anisotropy and point sources) and the high energy physics (inelastic cross-section, the role of charmed particles in the longitudinal EAS development). The structure of the first stage of EAS-1000: the EAS-100 array (acquisition and control systems) is also discussed.

8-LDS-18C

Status of the Cosmic Ray Experiment KASCADE

The KASCADE Collaboration, presented by H.J. Gils
Kernforschungszentrum Karlsruhe, Germany

The main aim of the air shower experiment KASCADE is to obtain information about the chemical composition of primary cosmic rays in the energy range 300 TeV to same 10 PeV. The arrangement consists of three main components, an array of about 250 detector stations distributed on a quadratic grid of 200 m * 200 m edge length, a compact central detector of 320 m^2 size, and a 50 m long and 5 m wide underground tunnel located close to the central detector. The detector array registers the numbers of both electrons and muons. With the calorimetric central detector the number and energy of hadrons and the number of high energy muons in the shower core are determined. In the well shielded underground tunnel tracking detectors for muons are installed. The status of the experiment, which is presently coming into operation with part of the detectors, will be described.

8-LDS-19C

Muon counting with the KASCADE-Array

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In the air shower experiment KASCADE, the muon component of an EAS is measured by different techniques. One detector type based on plastic scintillator material covers an area of $622m^2$ and consists of 192 detector units ($3.25m^2$ each). The segmented setup of such units allows a special interpretation of the detector signal to account for misinterpretation in the muon number.

The effect of electromagnetic respective hadronic punch through across the 20 radiation length lead absorber will be discussed.

In contrast to the e/γ–case, the analysis of the muon lateral distribution suffers from a poor particle density. Hence fit–functions, more adapted to the shape of the shower front will be presented.

8-LDS-20C

ANGULAR RESOLUTION OF EAS ARRAY USED AS A TELESCOPE IN UHE GAMMA RAY ASTRONOMY

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The Baksan Air Shower Array (BASA) has threshold energy for UHE gamma ray astronomy about 10^{14} eV. The unique feature of this array is large area (200 m^2) central "Carpet" allowing detailed study of central part of extensive air showers and precise core location. Six huts with 9 m^2 of scintillators in each are located at the distances 30 m and 40 m from the centre. Measurements of delays of shower signals in all huts permit to determine shower arrival direction. The accuracy of angle reconstruction is not easy to estimate, as there is no "standard candle" in the sky to check the absolute position of this source, as well as angular resolution of the array. One possibility to have at least a "negative source" for calibration is to observe the Sun and the Moon shadows in the flux of showers produced by background cosmic rays. The other one is the analysis of distribution of excess events in possible transient sources (bursts). One such event confirmed by several arrays was recorded from the Crab Nebula on 23 Feb 1989. We investigated both the possibilities and the results of the analysis are discussed.

8-LDS-21C

MC Simulation of Atmospheric Cherenkov Light for a System of 5 Imaging Cherenkov Telescopes

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Monte Carlo Simulations for a system of 5 Cherenkov telescopes have been done. Such telescope array is under construction at the Canary island La Palma. The simulations have been done for photon showers and different primary nuclei in the energy range from 0.7 TeV to 100 TeV. Aspects of the observation under large zenith angles have been included.

8-LDS-22P

.Muon arrival time distributions as a signature of the mass composition of cosmic rays

G. Völker, H. Rebel and A. A. Chilingarian *
Kernforschungszentrum Karlsruhe, Germany

The central detector of the KASCADE experiment will be equipped with a trigger and fast timing facility which enables measurements of the arrival time distributions of muons from extensive air showers (EAS). In particular, at larger distances from the shower axis the arrival time distributions are expected to map the longitudinal development of the showers in the atmosphere and may provide additional information about the nature of the primary particle through differences of the mean-free paths and the interaction cross sections with air nuclei.

We have investigated this aspect with respect to the KASCADE setup on the basis of EAS-simulations using the Monte-Carlo code CORSIKA [1]. The mean arrival time distributions of muons, observed at various distances from the shower core and for different primary energies and showers sizes, respectively, have been analysed with advanced statistical techniques [2] (based on Bayes decision rules and nonparametric multivariate analysing methods) in order to specify the merits the mean arrival time information of the muon component as a signature for the mass composition of cosmic rays.

[1] J.N. Capdevielle et al KfK Report 4998 (November 1992)

[2] A. A. Chilingarian, Computer Physics Comm. 54 (1989) 381

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8-LDS-23P

SPECTROSCOPY OF HIGH ENERGY COSMIC MUONS WITH THE ELECTROMAGNETIC CALORIMETER "WILLI"

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Related to the experiment KASCADE, in the frame of an international collaboration, an electromagnetic calorimeter: burst counter "WILLI" (Weakly Ionising Lepton Lead Interaction) detector for the energy determination of cosmic rays muons in the energy range of 1 to 30 TeV is under construction in IFA Bucharest, as a prototype study for cosmic rays measurements. It is based on direct pair production by high energy muons, observed as subsequent electromagnetic showers in an adequate calorimeter setup. The detector is planned to consist of a vertical stack with 30 passive lead layers of 1 cm thickness and 30 scintillators (90x90x3 cm) as active layers.
From the observed number of interactions, the deposited energy and the profile of electromagnetic cascades, examined by extensive Monte-Carlo simulations using the GEANT code, information on the energy of the primary muons can be inferred. For the reconstruction of the muon energy, the Maximum Likelihood Method is applied.

8-LDS-24P

Measurement of the EAS Time Structure with the KASCADE–Array

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The KASCADE–Array consists of 16 subarrays, so-called clusters, equipped with scintillation detectors for the observation of the electromagnetic and muon component of an extensive air shower. In addition to the measurement of the number of arriving particles and the arrival time of the first particle it is planned to install a number of Flash ADCs. Analysing the sampled pulse shapes allows to determine the time distribution of the arriving particles.

The main purpose is to get more information about a shower event, which will probably improve the reconstruction of the primary shower parameters, like composition, energy and direction. A second aim is, to investigate the nature of delayed particles, which arrive a few hundreds of nanoseconds after the shower disk.

Test measurements taken with a sampling oscilloscope in a satellite detector station 100m away from the triggering cluster are presented and compared with Monte-Carlo simulations.

8-LDS-25P

ARTEMIS: Antimatter Research Through Earth Moon Ions Spectrometer

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ARTEMIS is an atmospheric Cerenkov imaging experiment in the UV range, that aims to detect extra-galactic antiprotons. Another aim is to extend the duty-cycle of Cerenkov gamma-ray telescopes by opbserving the Crab under moon-lit skies. This experiment is installed at the Whipple Obsetvatory (Mt. Hopkins, Arizona). We present the technical results of UV Cerenkov imaging observations of the Crab in order to confirm the detection efficiency in UV before trying to search for a possible antiproton deficit due to the moon.

8-LDS-26P

The Optimization of the Angular Resolution for EAS of the HEGRA Scintillator Array

HEGRA Collaboration
presented by J. Prahl

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An improved method for the reconstruction of the direction for EAS registered in a scintillator array is presented. In this method the procedure of the shower front fitting uses weights depending on the number of particles in each counter and also on the distance from the shower axis. In addition to the dependance on this distance, it takes into account the dependance of the measured time in each counter on the number of particles registered. For showers with N(e) = 40,000 an angular resolution (63% value) of 0.62 degrees can be achieved, and it can be well described to be proportional to 1/sqrt(N(e)).

This improved method is then applied to the data from a possible burst from Cyg-X3 in Jan. 1991 as recorded by the HEGRA scintillator array. The results are compared to those obtained with procedures formerly used.

8-LDS-27P

Investigation of the Composition by Measurement of the Arrival Time Distribution of Air Cerenkov Light with Fast Flash-ADCS

HEGRA Collaboration
presented by V. Haustein

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For a part of the AIROBICC counters of the HEGRA array a fast Flash-ADC system has been set up to digitize the air Cerenkov light arrival time distribution in 1 respectively 2.5 ns steps. The arrival time and the pulse width (FWHM) at distances of 150-200m from the core give clues to the longitudinal development of air showers in the atmosphere and therefore to the nature of the primary particle. Measurements are presented and compared with CORSIKA 4.01/4.06 Mte Carlo simulations in the energy range 0.5 - 10 PeV.

8-LDS-28P

Reconstruction of EAS core Positions Outside an Array

HEGRA Collaboration
presented by V. Henke

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The width of the arrival time distribution for Cerenkov photons emitted from an airshower depends on the distance to the shower axis. For an AIROBICC like Cerenkov detector array the core position of an airshower can therefore be reconstructed from the arrival time distributions (FWHM) of the Cerenkov photons alone. It is shown that this is also possible with goood precision for showers with a core position outside the array, thus enlarging the effective area for reconstructable showers. Results from a Monte Carlo study are presented.

8-LDS-29P

Gamma/Hadron Separation with Wide-Angle Čerenkov Arrays between 20 and 500 TeV

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A method for γ/hadron separation usable in wide-angle air-Čerenkov arrays is presented. This technique provides a promising new approach to ground based γ-ray astronomy in an energy range just above that accessible by air-Čerenkov telescopes. As an example we apply this method in a full quantitative detail for the existing AIROBICC detector.

8-LDS-30P

METHODS SELECTIONS GAMMA-QUANTUM FROM PROTONS AT SHALON-ALATOO

V.G.Sinitsyna

Abstract

A short description of SHALON-ALATOO complex for gamma astronomical investigations in the range of gamma-quantum energies 1-30 TeV is given. The calibration of a telescope sensitivity is produced. The simulation of electron-photon cascades in the atmosphere for protons and gamma showers at the energies of 1 TeV is carried out for the experiments SHALON by means of Monte-Carlo method.

The analysis of results of observation of extensive air showers at the height of 3338 m above the sea level by means of gamma-telescope SHALON at the zenith angles 72°,76°, 84°, 96° are presented. The observation results are compared with the data of detection of showers according to the direction into the zenith.

CERENKOV PULSE SHAPE OF GAMMA AND HADRONIC UHE AIR SHOWERS. FIT TO ANALYTICAL FORMULAE

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Simulation of Cerenkov radiation produced by cosmic ray air showers has been performed. Cerenkov radiation by extensive air shower initiated by several cosmic rays has been simulated. Transverse development of Cerenkov radiation has been obtained. Transverse and longitudinal development has been correlated in order to discriminate between electromagnetic and hadronic. Cerenkov pulse shape was obtained as function of energy and primary kind of cosmic ray. The obtained pulses has been fitted, making use of Gamma function.

Time Calibration of the Light Cerenkov Detector

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A pulse optical generator is described for measuring time and amplitude characteristics of photomultiplier tubes. The generator is based on a light emitting diode working in avalanche mode with a rise time of 7 ns.

The time characteristics is measured by means of a constant fraction discriminator and CAMAC system with time channels. The time channel was developed by the Yerevan Insitute of Physics, Armenia and has a time resolution is 0.3 ns.

More than 200 tubes were measured and after selection they were collected in 4 groups to work with one high voltage supply. Seven complex photodetectors are collected with 19 PM each and the time resolution measured in Cerenkov wide angle telescope was about 1 ns.

8-LDS-33P

Coordinate Detector for Horizontal Cosmic Ray Muon Flux Investigations

ICGF - MEPhI collaboration
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A large area coordinate detector for investigations of the basic components of horizontal cosmic ray flux at ground level (muons, muon bundles, horizontal air showers) is being constructed in Moscow. The detector with effective area about 200 m^2 will include 4 vertical layers of limited streamer tube chambers. The detector will surround the Cherenkov water calorimeter (NEVOD) having a volume of 2000 cubic meters. Combination of the massive water calorimeter with a high resolution coordinate detector (1 cm measurement accuracy) will allow to study a wide range of cosmic ray physics problems.

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Cherenkov Water Detector for EAS Core Investigations

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Neutrino water detector (NEVOD) constructed on the Earth's surface may be used for EAS core detection. A substantial extension of the dynamic range of measuring system is required for these studies. Possibilities of signal registration from three different PMT dynodes are considered. A specialised micro- circuit designed for this purpose is developed. Some preliminary results are discussed.