Fr-3.
Extreme state of matter physics at FAIR

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The Facility for Antiproton and Ion Research in Europe, FAIR, will provide worldwide unique accelerator and experimental facilities allowing for a large variety of unprecedented fore-front research in extreme state of matter physics and applied science. Indeed, it is the largest basic research project on the roadmap of the European Strategy Forum of Research Infrastructures (ESFRI), and it is cornerstone of the European Research Area.

FAIR offers to scientists from the whole world an abundance of outstanding research opportunities, broader in scope than any other contemporary large-scale facility worldwide. More than 2500 scientists are involved in setting up and exploiting the FAIR facility. They will push the frontiers of our knowledge in hadron, nuclear, atomic and applied physics far ahead, with important implications also for other fields in science such as cosmology, astro and particle physics, and technology. It includes 14 initial experiments, which form the four scientific pillars of FAIR.

The main thrust of intense heavy ion and laser beam-matter interaction research focuses on the structure and evolution of matter on both a microscopic and on a cosmic scale.

This presentation outlines the current status of the Facility for Antiproton and Ion Research. It is expected that the actual construction of the facility will commence in 2010 as the project has raised more than one billion euro in funding. The sequence and scope of the construction will be described. Also the physics program of FAIR, based on the acquired funding, will be presented

Reference: www.gsi.de/fair/

Fr-4.
Ion beam heating for fast ignition

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The characteristics features of the formation of the spatial distribution of the energy transferred to the plasma from a beam of ions with different initial energies, masses and charges under fast ignition conditions [1,2] are determined. The notion of the Bragg peak is extended with respect to the spatial distribution of the temperature of the ion-beam-heated medium. The parameters of the ion beams are determined to initiate different regimes of fast ignition of thermonuclear fuel precompressed to a density of 300-500 g/cm^3 – the edge regime, in which the ignition region is formed at the outer boundary of the fuel, and the internal regime, in which the ignition region is formed in central parts of the fuel. The conclusion on the requirements for fast ignition by light [3,4] and heavy [1,5] ion beams is presented. It is shown that the edge heating with negative temperature gradient is described by a self-similar solution. Such a temperature distribution is the reason of the fact that the ignited beam energy at the edge heating is larger than the minimal ignition energy by factor 1.65. The temperature Bragg peak may be produced by ion beam heating in the reactor scale targets with ρR-parameter larger than 3-4 g/cm^2. In particular, for central ignition of the targets with ρR-parameter in the range of 4-8 g/cm^2 the ion beam energy should be, respectively, from 5 to 7 times larger than the minimal ignition energy.

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Fr-5.
LASERIX: an open facility for developments of soft X-ray and EUV lasers and applications

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LASERIX is a high-power laser facility designed to produce *High-repetition-rate XUV laser beams pumped by a Titanium:Sapphire laser.* The objectives are to develop soft X-ray lasers (SXRL) at various wavelengths and use them for applications. The facility is based on a titanium-doped sapphire (Ti:Sa), delivering pulse energy of 2 J at 10 Hz repetition rate at the exit of the front-end and 40 J before compression at 0.1 Hz repetition rate (using a Ti:Sa crystal amplifier of 10 cm in diameter).
The large width of the Ti:Sa spectrum opens the way to short pulses and to new SXRL schemes. Thus, LASERIX will provide the opportunity to study a large variety of SXRL schemes beside the conventional "transient collisional" one (OFI pumping, inner shell X-ray lasers, ...).
The 40-J beam will be basically divided in two parts that can be independently compressed, resulting in two beams of 10 J with a pulse duration which is continuously tunable between 40 fs and 500 ps. Three different EUV and soft x-ray beam lines will run simultaneously: An EUV DGRIP/GRIP laser line at 10Hz, a femtosecond EUV high order harmonic laser line at 10Hz and a high energy soft x-ray laser line at 0.1Hz.
This configuration highly enhances the scientific opportunities of the facility. Indeed it will be possible to perform both Soft X-ray laser experiments and more generally pump/probe experiments, mixing IR and EUV sources. Thus, this facility will provide to users opportunities for **a large range of Laser Interaction with Matter investigations**.
In this contribution, the main results concerning both the development of EUV and soft x-ray laser sources and their use for scientifical applications will be presented.
Finally, we will indicate the perspectives of the LASERIX facility in the near future, especially taking into account the national (Institut de la Lumière Extrême: ILE project, laboratories working on the development of the XUV sources) and international (Extreme Light Infrastructure project) contexts.

Fr-6.
Stochastic heating in high intensity laser-plasma interaction. Application to the wake field acceleration process

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Recently, PIC simulations results published by Tajima et al. and Sheng et al. have shown that chaos can play an important role in the efficient electron heating observed in laser-plasma interaction at very high intensities. These results led us to investigate the condition under which significant stochastic heating is likely to take place. First, we shall consider the dynamics of a single charged particle in the field of a high intensity wave propagating in an unmagnetized vacuum or plasma. In a second part, the effect of a constant homogeneous