EXPLANATION OF e+e- PEAKS IN HEAVY-ION COLLISIONS

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We calculate the kinetic energies of positrons and electrons produced in heavy-ion collisions using our **Neutral Nuclear Dust (NND) hypothesis** [1], wherein we assume that atleast one neutral boson (of mass $\sim 2m_e$) is bound to each nucleon inside the nucleus. The NND consists of an e+ and an e-.

Production of e+e- in heavy-ion collisions is a three step process, viz., NND affinity resonance, nuclear electrostatic, and nuclear magnetic interactions. The affinity resonance arises due to the interaction of the corresponding dust paricles in the projectile and the target nuclei. Now these dust particles are polarised by the intense nuclear electric field E which is of the order of 10^{21} Vm^{-1}. The polarised positrons and electrons are within the combined superstrong nuclear magnetic field [2] B ($\sim 10^{11}$ T) at the peripheral distance 'a' equal to 1.875 fm. The new born e+ and e- from the NND are lifted and ejected by this field from the colliding system as a two-directional e+e- gun. This can account for the back-to-back emission of the correlated e+e- coincidence events. Now the kinetic energy of positrons or electrons ϵ_k is given by

$$\epsilon_k = (N_d + 3/2)\ B\ e\ v\ a, \qquad (1)$$

where N_d is the 3-D harmonic oscillator energy level quantum number which takes the values from 0 to 6, e the electronic charge and v the velocity of the projectile ion. Multiple peaks (discreteness [3]) arise due to the decay of NND from different shells of the nucleus. In our calculations we found the 320 keV prominent peak arising due to the decay of dust particles from the sixth shell (N_d = 5) of the nucleus (see Table I). This shell is almost in the periphery of the nucleus having more number of nucleons than its inner ones.

References [4] and [5] (the non-conservation of mass and the Q value of the elastic or quasi-elastic scattering) are highly in favour of NND hypothesis, showing that the GSI spectrum is triggered by nuclear effects. The calculated values of kinetic energies of positrons or electrons agree very well with the experimental values. Our hypothesis can explain the origin of e+ peaks with independent of Z_u and back-to-back emission of e+e- in heavy-ion collisions.

Table I. Calculated kinetic energies (in keV) of positrons (or electrons) for different colliding systems comprising five supercritical (cols. 2 to 6) and three sub-critical (cols. 7 to 9). N_d varies from 0 to 6. BE/u = Binding energy per nucleon.

BE/u MeV	6.07	6.02	5.8	5.83	5.75	5.9	5.9	5.7
Z_u	188	186	184	182	180	171	165	164
N_d								
0	79	78	75	75	74	78	75	71
1	132	130	125	125	123	130	126	118
2	184	182	175	175	172	183	176	166
3	237	234	225	225	222	235	227	213
4	290	286	275	275	271	287	277	260
5	343	338	326	325	320	340	328	308
6	396	390	376	375	370	392	378	355

References

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