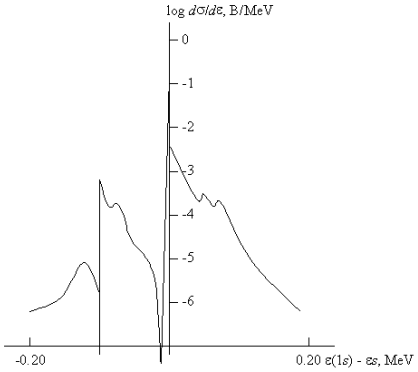
RESONANCE STATES OF COMPOUND SUPERHEAVY NUCLEUS AND ELECTRON-POSITRON PAIR PRODUCTION IN HEAVY NUCLEI COLLISIONS

A. V. Glushkov[a,b], S.V.Ambrosov[a], and A.V.Loboda[b]
[a] *Atom.-Nucl.-Laser Spectr.Centre OEU, P.O.Box 116, Odessa-9, 65009, Ukraine*
[b] *Institute Applied Mathematics OEU, P.O.Box 116, Odessa-9, 65009, Ukraine*

A great interest to problem is stimulated by inaugurating the heavy-ion synchrotron storage cooler ring combination SIS/ESR at GSI [1]. It's known discovery (the ORANGE and EPOS collab. at GSI in Darmstadt) of the existence of narrow and unexpected e^+ line in the positron spectra obtained from heavy ions collisions. Here a consistent unified quantum mechanics and QED approach is developed and applied for studying the electron- positron pair production (EPPP) process in the heavy nuclei (ions) collisions [2,3]. The positron spectrum narrow peaks as a spectrum of the resonance states of compound superheavy nucleus is treated. Resonance phenomena in the nuclear system lead to the structurization of the positron spectrum produced. The nuclear subsystem and electron subsystem has been considered as two parts of the complicated system, interacting with each other through the effective potential. The nuclear system dynamics has been treated within the Dirac equation. The quality of the modelling for nuclear potential may have a decisive importance. All the spontaneous decay or the new particle (particles) production processes are excluded in the zeroth order. To calculate the EPPP cross-section, we use modified versions of the relativistic energy approach, based on the Gell-Mann and Low formalism [2,3]. The calculation (with two-pocket nuclear potential) is carried out for the U+U system and led to principally the same physical picture as a calculation with one-pocket one [2], besides the appearance of some new peaks. The detailed analysis of calculation results for the process cross-section at different collision energies (corresponding to energies of s-resonances of the compound U-U nucleus) is presented. In fig. the differential cross-section $d\sigma(\varepsilon s, E_1)/d\varepsilon s$ plotted against $\varepsilon(1s)$-εs (in B MeV^{-1}) for the nuclear subsystem collision energy E_1 = 247.6 keV is presented.



[1] P.Kienle, Phys.Scr. **46**, 81 (1993); I.König etal, GSI Preprint 92-49 (1992).

[2] A.V.Glushkov,L.N.Ivanov, J.Phys.B **26**, 379(1993); L.N.Ivanov, T.V.Zueva, Phys.Scr. 43, 374 (1991); L.N.Ivanov, A.Glushkov etal, *Preprint ISAN*, Russian AS, 92-5,Moscow (1992).

[3] A.V.Glushkov et al, In: New Projects and New lines of research in Nuclear Physics, eds. Fazio G. and Hanappe F., World Pub., Singapore,2003.