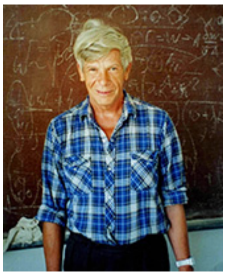

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Quantum-quasiclassical analysis of CM coupling with internal motion in atoms due to relativistic effects stimulated by laser field

Monday, 10 October 2022 14:30 (25 minutes)

We discusses the efficient quantum-quasiclassical method developed by V.S. Melezhik with co-authors [1-4], which has been successfully applied to calculate various few-body processes and has made it possible to resolve a number of topical problems in atomic [1,3-5], mesoatomic [2], and nuclear physics [6]. In this approach, a few-body quantum problem is reduced to the simultaneous integration of a system of coupled quantum and classical equations: the time-dependent Schrödinger equation, which describes the quantum dynamics of slow light particles, and the classical Hamilton equations, describing the fast variables of heavy particles.
Recently [5], the approach was extended and adapted for quantitative description of pair collisions of light slow Li atoms with heavy Yb+ ions in the confined geometry of the hybrid atom-ion trap. On the basis of these calculations, a new method for sympathetic cooling of ions in a RF Paul trap was proposed. This approach also made it possible to perform calculations of the breakup cross sections into the low-energy region (up to 10 MeV/nucleon), in inaccessible so far to other methods, for the 11Be breakup on a heavy target [6].
The main focus in the report will be made on our recent analysis within the frame of this approach of the coupling between the center-of-mass (CM) and electronic motions in a 6D hydrogen atom, which arises in strong laser fields due to relativistic effects. In this case, the CM dynamics is treated classically, while the electronic motion is treated quantumly. So, in this approach it is naturally to investigate the idea proposed in the work [7] to use the CM-velocity spectroscopy (classical set up) for detecting the internal electron quantum dynamics.
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