On three three-dimensional charged quantum particles scattering problem with attraction in pair subsystems

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Abstract

We study the scattering problem of three three-dimensional unlike-charged quantum particles following the diffraction approach. The method was introduced earlier for the system of three one-dimensional neutral particles and developed later. Here we take into consideration the most interesting and also most complicated case of scattering problem of three three-dimensional charged quantum particles including the attraction in pair subsystems. The diffraction approach for the few-body problems of quantum scattering with slowly (Coulomb case) decreasing repulsive pair potentials was discussed earlier in literature. It allows in some sense to generalize the known works of E.Alt and A Mukhamedzhanov and construct the uniform in all angular variables continuous spectrum eigenfunctions asymptotics at infinity in configuration space. Nevertheless the most interesting from the physical point of view case of few unlike-charged quantum particles (or even clusters) scattering problem, which includes for example the low-energy charge atomic and molecular clusters re-arrangement, ionization and so on, is still not completely solved up to now in spite of a large amount of works dedicated to this problem. One of the main reasons of that is connected with the slowly decreasing pair potentials, which leads to the absence of asymptotic freedom and consequently to complications in the construction of asymptotic boundary conditions. Another reason of the complications is connected with attractive coulomb pair potentials and appearing of discrete spectrum (and even accumulative point of the discrete spectrum) of pair subsystems Hamiltonians. Consequently, the proble m is connected with a mathematically correct account of pair subsystems discrete spectrum accumulative points. Here we discuss this problem from the point of view of the diffraction approach. Finally, it allows describing the contributions of the coulomb discrete spectrum accumulative points of subsystem Hamiltonians to the structure of the three-body continuous spectrum eigen functions.

Recent Publications

1. V S Buslaev and S B Levin (2008) To the question of the existence and uniqueness of the scattering problem solution. The case of three one-dimensional quantum particles interacting by finite repulsive pair potentials. Amer. Math. Soc. Transl 225: 55-71.

2. V S Buslaev and S B Levin (2011) Asymptotic behavior of eigenfunctions of the three-particle Schrödinger operator. II. Charged one-dimensional particles. St.Petersburg Math.J. 22: 379-392.

3. V S Buslaev and S B Levin (2012) A system of three three-dimensional quantum particles: The asymptotic behaviour of continuous spectrum eigenfunctions at infinity. Functional Analysis and its Applications 46 (6): 147-151.

4. Ya Yu Koptelov, S B Levin (2014) On asymptotics of the scattering problem of few charged quantum particles. Physics of Atomic Nuclei. 77(4): 528-536.

**Biography**

S B Levin has his expertise in Atomic Physics and Mathematical Physics. He has completed his PhD from St-Petersburg University. He is an Associate Professor at the Faculty of Physics, Department of Mathematical Physics, focusing his research on Atomic Physics mathematical models. He worked as a Postdoc and Research Assistant at Stockholm University and he also worked as a Guest Researcher at Mainz University (2001) and Harvard University (ITAMP) (2002).

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Notes/Comments: