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SPECTRAL AND SCATTERING THEORY FOR 3-PARTICLE HAMILTONIAN WITH STARK EFFECT: NON-EXISTENCE OF BOUND STATES AND RESOLVENT ESTIMATE

HIDEO TAMURA

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Introduction

The present work is a continuation to [16], in which the author has proved the asymptotic completeness of wave operators for three-particle Stark Hamiltonians. In the proof there, the following two results about the spectral properties of two-particle subsystem Hamiltonians have played a central role: (1) non-existence of bound states; (2) uniform resolvent estimate at high energies. We here consider these two problems for three-particle systems and apply the obtained results to prove the asymptotic completeness for four-particle Stark Hamiltonians under the main assumption that any subsystem Hamiltonian does not have zero reduced charge.

1. Non-existence of bound states

The first half of this work is devoted to proving the non-existence of bound states for three-particle Stark Hamiltonians. We consider a system of three particles moving in a uniform electric field $\mathcal{E}\in\boldsymbol{R}^3$. The total energy Hamiltonian for such a system has the form

$$-\sum_{j=1}^{3}(\Delta/2m_j+e_j\langle\mathcal{E},r_j\rangle)+\sum_{1\leq j<k\leq 3}V_{jk}(r_j-r_k)\,.$$

Here m_j, e_j and $r_j\in\boldsymbol{R}^3$, $1\leq j\leq 3$, are the mass, charge and position vector of the j-th particle, while $-e_j\langle\mathcal{E},r_j\rangle$, $\langle,\rangle$ being the usual scalar product in the Euclidean space, is the energy of interaction with the electric field and the real function V_{jk} is the pair potential between the j-th and k-th particles. For notational brevity, we assume that the three particles have the identical masses

$$m_j=1,\quad 1\leq j\leq 3\,.$$

For the three-particle system with identical masses, the configuration space X in the center-of-mass frame is described as