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Asymptotic Completeness for Long-Range Many-Particle Systems with Stark Effect. II

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Abstract: We prove the existence and the asymptotic completeness of the Dollard-type modified wave operators for many-particle Stark Hamiltonians with long-range potentials.

1. Introduction

The present paper is a continuation to the work [AT] where we have proved the asymptotic completeness of the Graf-type modified wave operators for many-particle Stark Hamiltonians with a class of long-range potentials. We here study the problem of the asymptotic completeness for many-particle Stark Hamiltonians with a larger class of long-range potentials.

We consider a system of N particles moving in a given constant electric field $\mathscr{E} \in \mathbf{R}^3$, $\mathscr{E} \neq 0$. Let m_j, e_j and $r_j \in \mathbf{R}^3$, $1 \leqq j \leqq N$, denote the mass, charge and position vector of the j^{th} particle, respectively. The N particles under consideration are supposed to interact with one another through the pair potentials $V_{jk}(r_j - r_k)$, $1 \leqq j < k \leqq N$. Then the total Hamiltonian for such a system is described by

$$\tilde{H} = \sum_{1 \leqq j \leqq N} \left\{ -\frac{1}{2m_j} \Delta_{r_j} - e_j \mathscr{E} \cdot r_j \right\} + V \,,$$

where $\xi \cdot \eta = \sum_{j=1}^{3} \xi_j \eta_j$ for $\xi, \eta \in \mathbf{R}^3$ and the interaction V is given as the sum of the pair potentials

$$V = \sum_{1 \leqq j < k \leqq N} V_{jk}(r_j - r_k) \,.$$

As usual, we consider the Hamiltonian $\tilde{H}$ in the center-of-mass frame. We introduce the metric $\langle r, \tilde{r} \rangle = \sum_{j=1}^{N} m_j r_j \cdot \tilde{r}_j$ for $r = (r_1, \ldots, r_N)$ and $\tilde{r} = (\tilde{r}_1, \ldots, \tilde{r}_N) \in \mathbf{R}^{3 \times N}$. We use the notation $|r| = \langle r, r \rangle^{1/2}$. Let X and X_{cm} be the configuration spaces