Tamura, H.
Osaka J. Math.
29 (1992) 135–159

SPECTRAL AND SCATTERING THEORY FOR 3-PARTICLE HAMILTONIAN WITH STARK EFFECT: ASYMPTOTIC COMPLETENESS

Dedicated to Professor Shige Toshi Kuroda on his 60th birthday

HIDEO TAMURA

(Received May 7, 1991)

1. Introduction

In the present work we prove the asymptotic completeness for 3-particle Schrödinger operators with Stark effect. Consider a system of three particles in a uniform electric field $\mathcal{E}\in \boldsymbol{R}^3$. The energy Hamiltonian for such a system takes the form

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

where m_j, e_j and $r_j\in\boldsymbol{R}^3$, $1\leq j\leq 3$, denote 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 potential interaction between the j-th and k-th particles.

During the last decade, the spectral and scattering theory of many particles in the absence of electric field has made major progress by many works [2,9, 11,13]. Among these works, Sigal-Soffer [13] first proved the asymptotic completeness of wave operators for N-particle scattering systems with a large class of short-range potentials (see also Graf [4] and Tamura [14]). The spectral and scattering theory of one(two)-particle systems in the presence of electric field has been also studied by many authors [1,5,6,10,15], but there seems to be only a few works on the scattering problem of many-particle systems. Korotyaev [8] has proved the asymptotic completeness of 3-particle systms by making use of the Faddeev equation method. We here prove the asymptotic completeness of wave operators by a different method. The idea of proof, which is, in principle, similar to that in [13], is based on the Mourre commutator method and on the propagation estimate showing that the relative motion of particles is asymptotically concentrated on classical trajectories. In particular, it is not necessarily assumed that a 2-particle subsystem Hamiltonian with zero reduced charge does not have a zero energy resonance. This improves slightly the results