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Spectral Analysis of N-Body Stark Hamiltonians

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Abstract: We prove that the spectrum for a large class of N-body Stark Hamiltonians is purely absolutely continuous. We need slow decay at infinity and local singularities of at most Coulomb type. In particular our results include the usual models for atoms and molecules.

Section 1. Introduction

In this paper we prove absence of pure point and singular continuous spectra for a large class of N-body Stark Hamiltonians. The model is the following. We consider a system of N ν-dimensional particles labelled $1,\ldots,N$ with masses, charges, positions and momenta denoted by m_l, q_l, x_l, and p_l, respectively. The interaction consists of two parts. One part (the external part) is due to the presence of an electric field $\mathscr{E}$, while the other part (the internal interaction) is given as a sum of pair potentials each one, v_{lj}, assumed to obey the (weak) decay condition,

$$|v_{lj}(y)| + |\nabla v_{lj}(y)| = o(1) \quad \text{for} \quad y \to \infty . \tag{1.1}$$

Here and in the first part of this introduction we shall assume v_{lj} to be C^1. We defer the discussion of adding local singularities to the last part of the introduction. The total Hamiltonian reads

$$\tilde{H} = \sum_{l=1}^{N} \left(\frac{p_l^2}{2m_l} - q_l \mathscr{E} \cdot x_l \right) + \sum_{1 \leqq i < j \leqq N} v_{lj}(x_l - x_j) .$$

After the (standard) procedure of separating out the center of mass motion for $\tilde{H}$ we obtain a Hamiltonian H on $L^2(X)$, where

$$X = \left\{ x = (x_1, \ldots, x_N) | x_l \in \mathbf{R}^\nu, \ \sum_{l=1}^{N} m_l x_l = 0 \right\} .$$

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