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Time Evolution of Infinite Classical Systems with Singular, Long Range, Two Body Interactions

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Abstract. Existence of dynamics for infinitely many hard-spheres in ν dimensions is proven in a set of full equilibrium measure.

Singular unbounded perturbations are considered with pair potentials diverging as $(x-a)^{-\lambda}$, $\lambda>2$ and a is the hard-core diameter. Long range forces are allowed with potentials decreasing at infinity as $x^{-\lambda'}$, $\lambda'>\nu$. The result corrects and generalizes a proof given in a previous paper by the same authors.

1. Introduction

This is a revised and corrected version of a previous paper [1] by the same authors. In that work the existence of dynamics for infinitely many one dimensional hard-rods was considered. Since then many results have been obtained, dynamics has been proven to exist in more general cases [2–4] and therefore one of the aims of that paper, to provide clues to the many dimension extension is no more actual.

However the techniques so far used [1–5] either required a Lipschitz assumption on the pair potential [3, 4] or a probabilistic (statistical) proof that dynamics is essentially finite, in the sense that the particles are grouped into finite, mutually non interacting clusters [2, 5].

The purpose of this paper is to exploit a method used in [1] to relax the Lipschitz condition on the pair potential and to prove the existence of dynamics without any finite cluster consideration: therefore no restriction is required on the range of values of temperature and chemical potential. In this paper we treat pair potentials $\Phi(r)$ which suitably diverge at the hard-core distance, we need the [presumably technical] condition that $\Phi(r)$ behaves as $(r-a)^{-\lambda}$, $\lambda>2$ for $r\to a$. Long range potentials are allowed, see D 2.2.

Since our approach applies to the many dimensional case as well, this is what we treat here: no main difference in procedure exists with respect to the one-dimensional case.

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