Diffusion approximation for equilibrium Kawasaki dynamics in continuum

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A Kawasaki dynamics in continuum is a dynamics of an infinite system of interacting particles in $\mathbb{R}^d$ which randomly hop over the space. In this paper, we deal with an equilibrium Kawasaki dynamics which has a Gibbs measure μ as invariant measure. We study a diffusive limit of such a dynamics, derived through a scaling of both the jump rate and time. Under weak assumptions on the potential of pair interaction, ϕ, (in particular, admitting a singularity of ϕ at zero), we prove that, on a set of smooth local functions, the generator of the scaled dynamics converges to the generator of an equilibrium diffusive dynamics of an infinite system of interacting particles. If the set on which the generators converge is a core for the diffusive generator, the latter result implies the weak convergence of finite-dimensional distributions of the corresponding equilibrium processes. In particular, if the potential ϕ is from $C_b^3(\mathbb{R}^d)$ and sufficiently quickly converges to zero at infinity, we conclude from a result in [Choi *et al.*, J. Math. Phys. 39 (1998) 6509–6536] that the convergence of process holds when the limiting diffusion is the gradient stochastic dynamics.