Condensed Matter > Statistical Mechanics

A simple particle model for a system of coupled equations with absorbing collision term

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We study a particle model for a simple system of partial differential equations describing, in dimension $d\geq 2$, a two component mixture where light particles move in a medium of absorbing, fixed obstacles; the system consists in a transport and a reaction equation coupled through pure absorption collision terms. We consider a particle system where the obstacles, of radius $\var$, become inactive at a rate related to the number of light particles travelling in their range of influence at a given time and the light particles are instantaneously absorbed at the first time they meet the physical boundary of an obstacle; elements belonging to the same species do not interact among themselves. We prove the convergence (a.s. w.r.t. the product measure associated to the initial datum for the light particle component) of the densities describing the particle system to the solution of the system of partial differential equations in the asymptotics $ a_n^d n^{-\kappa}\to 0$ and $a_n^d \var^{\zeta}\to 0$, for $\kappa\in(0,\frac 12)$ and $\zeta\in (0,\frac12 - \frac 1 {2d})$, where a_n^{-1} is the effective range of the obstacles and n is the total number of light particles.

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