# Spatially Inhomogeneous Host-Vector Disease Transmission using Configuration Space Analysis

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**Abstract**

In this article we consider a microscopic model for the host-vector disease transmission based on configuration space analysis. We model transmission with a birth-death mechanism in the vector component and mobility in the host component. Our intension is to show that a Vlasov type scaling, which is a mean-field-like scaling of an interacting particle system, leads to the known equations used in epidemiology to model host-vector disease spread on the kinetic level. Configuration space analysis is here a very powerful tool. The concepts of harmonic analysis in this framework are used to derive first the dynamics of correlation functions - giving a hierarchical system of equations comparable to the well known BBGKY hierarchy in Hamiltonian dynamics. A proper Vlasov type scaling guaranties that the resulting Vlasov hierarchy is closed and possesses the property of preservation of chaos. The limiting system of time evolution equations is non-linear and strongly related to the well-known Fisher-KPP equations. A numerical analysis strengthens the analytical results. Moreover, the dynamics of case numbers over time gives qualitatively the solution of a SISUV-ODE system. The microscopic dynamics hence leads to the right behavior in the scaling limit.

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