Kinetic Behaviour of the Aggregation-Annihilation Process of Two-Species-Group System

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Abstract: The kinetic behavior of an aggregation-annihilation system with two species groups is studied in this paper. We propose that an aggregation reaction occurs only between the same species and an irreversible joint annihilation reaction occurs only between the two species belonging to distinct groups. Based on the mean-field theory, we investigate the rate equations of the process with constant reaction rates and obtain the asymptotic descriptions of the cluster-mass distributions for the symmetrical cases. We find that the cluster-mass distribution of each species obeys a standard scaling description in certain cases. Meanwhile, breakdown of the standard scaling description is also found for the distribution in some special cases and the cluster-mass distribution comes in a peculiar scaling regime. The evolution behaviour of the system depends crucially on the reaction rates and the ratio of initial concentrations between the two groups. Moreover, the species numbers of the two groups also play important roles in the properties of the cluster distributions.

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