

Disordered zero-range process in one dimension and condensation phenomena

Jun Ohkubo

*Institute for Solid State Physics, University of Tokyo
5-1-5 Kashiwanoha, Kashiwa-shi, Chiba 277-8584, JAPAN*

We propose a new model for a totally asymmetric, disordered zero-range process (ZRP) in one dimension. In the most general ZRP, a hopping rate, which depends on the number of particles (mass) in a site, is assigned to each site; ‘one of the particles’ in a site is moved to the nearest sites with the hopping rate. The ZRP proposed here has a different hopping mechanism: ‘each particle’ has a mass-dependent and site-dependent hopping rate, and ‘each particle’ is moved to the nearest sites with the hopping rate. Hence, one can say that the ZRP obeys Maxwell-Boltzmann statistics, in which particles in a site are distinguishable. In addition, we assume that each site has its own parameter related to the hopping rate (quenched disorder). Using the replica technique, we calculate the occupation distribution analytically. Furthermore, it is revealed that the ZRP shows a condensation phenomenon in spite of the ‘classical’ (Maxwell-Boltzmann) aspect, and the condensation phenomenon occurs only in a disordered case.