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Phase Transitions of Ballistic Annihilation

Ballistic annihilation is a simple annihilating particle system motivated by the study of the kinetics of chemical reactions. In it, particles with presampled random velocities move across the real line and mutually annihilate upon collision. Many results were inferred by physicists, but it was only until recently that rigorous mathematical solutions were derived. In this talk, I will discuss Haslegrave—Sidoravicius—Tournier's breakthrough result in the symmetrical three-velocity setting and introduce two variants, for which we are able to prove the existence of phase transitions and compute the critical density despite considerably more complicated dynamics.