Planckian Interacting Massive Particles as Dark Matter and Gravitational Atoms

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Within the Lambda-CDM framework, Planckian Interacting Dark Matter (PIDM) is a minimal paradigm for dark matter with only one free parameter (the dark matter mass), and the interactions with the standard model of particles fixed by the equivalence principle. The correct PIDM abundance can be successfully obtained by gravitational scattering in the initial thermal plasma of the Standard Model sector if the reheating temperature is sufficiently high, for PIDM masses ranging between 100GeV and the GUT scale. The important case of a GUT scale PIDM mass interestingly predicts the existence of a small abundance of gravitational atoms in the early universe, whose decay into gravitational waves could in principle be looked for today. I will discuss the PIDM paradigm, focussing on the production mechanism, but also mention specific realizations of the PIDM in quantum gravity and known models of inflation. Finally I will review the surprisingly rich PIDM phenomenology, but with a focus on the gravitational atoms.