Astrophysics > Cosmology and Extragalactic Astrophysics

# Dark Matter Candidates from Particle Physics and Methods of Detection

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The identity of dark matter is a question of central importance in both astrophysics and particle physics. In the past, the leading particle candidates were cold and collisionless, and typically predicted missing energy signals at particle colliders. However, recent progress has greatly expanded the list of well-motivated candidates and the possible signatures of dark matter. This review begins with a brief summary of the standard model of particle physics and its outstanding problems. We then discuss several dark matter candidates motivated by these problems, including WIMPs, superWIMPs, light gravitinos, hidden dark matter, sterile neutrinos, and axions. For each of these, we critically examine the particle physics motivations and present their expected production mechanisms, basic properties, and implications for direct and indirect detection, particle colliders, and astrophysical observations. Upcoming experiments will discover or exclude many of these candidates, and progress may open up an era of unprecedented synergy between studies of the largest and smallest observable length scales.

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