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The Puzzling Darkness of Massive Milky Way Subhalos¹

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A firm prediction of the cold dark matter model of cosmological structure formation is that the Milky Way should host a huge population of self-bound dark matter subhalos. The vast majority of these subhalos are likely devoid of stars, but a tiny minority are expected to host the luminous dwarf galaxies observed around the Milky Way. These are the most dark matter-dominated galaxies presently known, and are therefore excellent laboratories for testing theories about galaxy formation and the properties of dark matter. I will discuss a new comparison of the structure and abundance of Milky Way satellite galaxies with predictions based on cold dark matter simulations, which has revealed a perplexing tension: massive dark matter subhalos, the putative hosts of luminous satellites, are much more dense than the observed dwarf galaxies orbiting the Milky Way. I will also review plausible explanations of this serious discrepancy, which include the possibility that galaxy formation is markedly different in low-mass dark matter halos than in larger systems, that baryonic processes wreak havoc on dark matter subhalos, or that the nature of dark matter differs from the canonical picture of a massive, weakly interacting particle.

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