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Heart of Darkness: The Significance of the Zeptobarn Scale for Neutralino Direct Detection[1] DAVID SANFORD, JONATHAN FENG, UC Irvine — The direct detection of dark matter through its elastic scattering off nucleons is among the most promising methods for establishing the particle identity of dark matter. The current bound on the spin-independent scattering cross section is $\sigma^{SI} < 40$ zb for dark matter masses $mneut \sim 100$ GeV, with improved sensitivities expected soon. We examine the implications of this progress for neutralino dark matter in a supersymmetric framework well-suited to dark matter studies that is simple and transparent, with models defined in terms of four weak-scale parameters. Robust constraints on electric dipole moments motivate large sfermion masses $\tilde{m} \gtrsim 1$ TeV, effectively decoupling squarks and sleptons from neutralino dark matter phenomenology. In this case, we find characteristic cross sections in the narrow range $1 \text{ zb} \lesssim \sigma^{\text{SI}} \lesssim 40$ zb for $m_\chi \gtrsim 70$ GeV. This range expands by at most a factor of two when relaxing model assumptions except in finely tuned regions, and does it change significantly due to varying the strange quark content of the nucleon, including the effects of galactic small-scale structure, or assuming other components of dark matter. Experiments are therefore rapidly entering the heart of dark matter-favored supersymmetry parameter space.

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