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Dark Matter from Monogem: Constraints on Velocity-Dependent Dark Matter-Nucleus Scattering

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Direct detection experiments set strong constraints on dark matter-nucleus scattering, but are typically limited to probing dark matter velocities of order $10^{-3} c$. If there exists a sub-population of dark matter with much larger velocity, considering this population could make direct detection experiments sensitive to smaller dark matter mass, while also improving their sensitivity to cross sections that scale strongly with velocity, as in nonrelativistic effective field theory. We show that supernova shocks, traveling at speeds much larger than typical dark matter velocities in the Milky Way, could produce a small but detectable flux of energetic dark matter particles. We use this observation to set competitive constraints on effective operators that scale strongly with dark matter velocity.

Collaboration name

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