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## Velocity-dependent Self-interacting Dark Matter I: New Constraints from Groups and Clusters of Galaxies

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Longstanding anomalies in astrophysical observations on small scales suggest that dark matter might not be collisionless, as is commonly assumed, but could have sizable self-interactions. For the first time, we probe the hypothesis of self-interacting dark matter (SIDM) at intermediate scales between galaxies and galaxy clusters. To model the SIDM halo density profiles, we employ an observation-driven approach, the so-called Jeans model. We validate our method by comparing with predictions from SIDM-plus-baryons simulations. So far, the limit on the self-interaction cross section from the Bullet Cluster is often cited as the strongest constraint on dark matter self-interactions. We show that the halo density profiles of *relaxed* systems like groups and clusters lead to much stronger bounds on the self-interaction cross section.

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