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Merging clusters as a test-bed for self-interacting dark matter

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Self-interacting dark matter (SIDM) has been proposed as a means to alleviate tensions on small scales between observations and simulations. A possible avenue for constraining the interaction cross-section is to study the major mergers of galaxy clusters. These mergers are defined by three components: galaxies, which act as collisionless test particles, gas, which is dissociated from the galaxies through ram pressure stripping, and DM. If the DM is collisionless, as it is in the cold DM (CDM) paradigm, it should remain coincident with the galaxies. However, if the DM is able to interact, it can be offset from the galaxies due to drag from the DM self-interactions. In my current project, I compare the offsets between the galaxies and DM in hydrodynamical simulations of clusters run with both CDM and SIDM physics. My first results show that, as expected, these offsets indeed increase with SIDM cross-section.

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