Contribution ID: **49** Type: **not specified**

Constraining Dark Matter Substructure With Gaia Wide Binaries

Tuesday 9 May 2023 14:00 (15 minutes)

We use a catalogue of stellar binaries with wide separations (up to 1 pc) identified by the *Gaia* satellite to constrain the presence of extended substructure within the Milky Way galaxy. Heating of the binaries through repeated encounters with substructure results in a characteristic distribution of binary separations, allowing constraints to be placed independent of the formation mechanism of wide binaries. Across a wide range of subhalo density profiles, we find that subhalos with masses 65 M and characteristic length scales similar to the separation of these wide binaries cannot make up 100% of the Galaxy's dark matter. Constraints weaken for subhalos with larger length scales and are dependent on their density profiles. For such large subhalos, higher central densities lead to stronger constraints. Subhalos with density profiles similar to those expected from cold dark matter must be at least ~5,000 times denser than predicted by simulation to be constrained by the wide binary catalogue.

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Session Classification: DM II

Track Classification: Dark Matter