Contribution ID: **31** Type: **Contributed Talk**

Dark matter limits from the tip of the red giant branch

Tuesday 10 December 2024 14:00 (30 minutes)

Capture and annihilation of WIMP-like dark matter in red giant stars can lead to faster-than-expected ignition of the helium core, and thus a lower tip of the red giant branch (TRGB) luminosity. We use Gaia data to place constraints on the dark matter-nucleon cross section using TRGB of 22 globular clusters with measured TRGB luminosities, and place projections on the sensitivity resulting from 161 clusters with full phase space distributions observed by Gaia. Although limits remain weaker than those from Earth-based direct detection experiments, they represent a constraint that is fully independent of dark matter properties in the Solar neighbourhood, probing its properties across the entire Milky Way galaxy, and help confirm the robustness of the TRGB as a standard candle.

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Session Classification: Dark Matter