Contribution ID: **33** Type: **not specified**

Dark Matter p-wave Annihilation Flux Enhancement Near the Supermassive Black Hole at the Center of M87*

Tuesday 27 June 2023 15:40 (20 minutes)

The existence of supermassive black holes at the center of galaxies redistributes the dark matter density profile in the region of influence and creates a higher density region so-called density spike. In the self-interaction dark matter scenario, the velocity dispersion in the spike region scales with a power law of rˆ−1/2, and the density spike scales with a power law of rˆ−(3+a)/4, where “a” is the parameter where the self-scattering scales with velocity. In this work, we calculate the J-factor and Q-factor for Sommerfeld-Enhanced s-wave and p-wave annihilation for the M87* galaxy and show that the p-wave annihilation flux can be enhanced and become at the same order as s-wave annihilation at higher dark matter masses.

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Session Classification: Parallel

Track Classification: Formal/strings