

Gamma rays from dark matter spikes in EAGLE simulations

Intermediate Mass Black Holes (IMBHs) with a mass range between 100 and 10^6 solar masses are expected to be surrounded by high dark matter densities, so-called dark matter spikes. The high density of self-annihilating WIMPs in these spikes leads to copious gamma-ray production. Sufficiently nearby IMBHs could therefore appear as unidentified gamma-ray sources. However, the number of IMBHs and their distribution within our own Milky Way is currently unknown. In this work, we provide a mock catalogue of IMBHs and their dark matter spikes obtained from the EAGLE simulations, in which black holes with a mass of $\sim 10^5$ solar masses are seeded into the centre of halos greater than $\sim 10^{10}$ solar masses to model black hole feedback influencing the formation of galaxies. The catalogue contains the coordinates and dark matter spike parameters for over 8700 IMBHs present in about 400 Milky Way-like galaxies. We expect about 19 IMBHs within our own galaxy, mainly distributed in the Galactic Centre and the Galactic Plane. We find that current and future gamma-ray observatories, such as Fermi-LAT, H.E.S.S. and CTA, would be sensitive enough to probe the cross section of dark matter self-annihilation around IMBHs below the thermal relic cross section for dark matter particles with masses from GeV to TeV. We have made the IMBH mock catalogue and the source code for our analysis publicly available, providing the resources to study dark matter self-annihilation around IMBHs with current and upcoming gamma-ray observatories.

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Session Classification: Contributed talks