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Detection of the Sagittarius Dwarf Spheroidal Galaxy in Gamma-Rays

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The Fermi Bubbles are giant, γ-ray emitting lobes emanating from the nucleus of the Milky Way discovered in ~1-100 GeV data collected by the Large Area Telescope on board the Fermi Gamma-Ray Space Telescope. Previous work has revealed substructure within the Fermi Bubbles that has been interpreted as a signature of collimated outflows from the Galaxy's super-massive black hole. Here we show via a spatial template analysis that much of the γ-ray emission associated to the brightest region of substructure –the so-called cocoon –is likely due to the Sagittarius dwarf spheroidal (Sgr dSph) galaxy. This large Milky Way satellite is viewed through the Fermi Bubbles from the position of the Solar System. As a tidally and ram-pressure stripped remnant, the Sgr dSph has no on-going star formation, but we nevertheless demonstrate that the dwarf's millisecond pulsar (MSP) population can plausibly supply the γray signal that our analysis associates to its stellar template. The measured spectrum is naturally explained by inverse Compton scattering of cosmic microwave background photons by high-energy electron-positron pairs injected by MSPs belonging to the Sgr dSph, combined with these objects' magnetospheric emission. This finding plausibly suggests that MSPs produce significant γ-ray emission amongst old stellar populations, potentially confounding indirect dark matter searches in regions such as the Galactic Centre, the Andromeda galaxy, and other massive Milky Way dwarf spheroidals.

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