

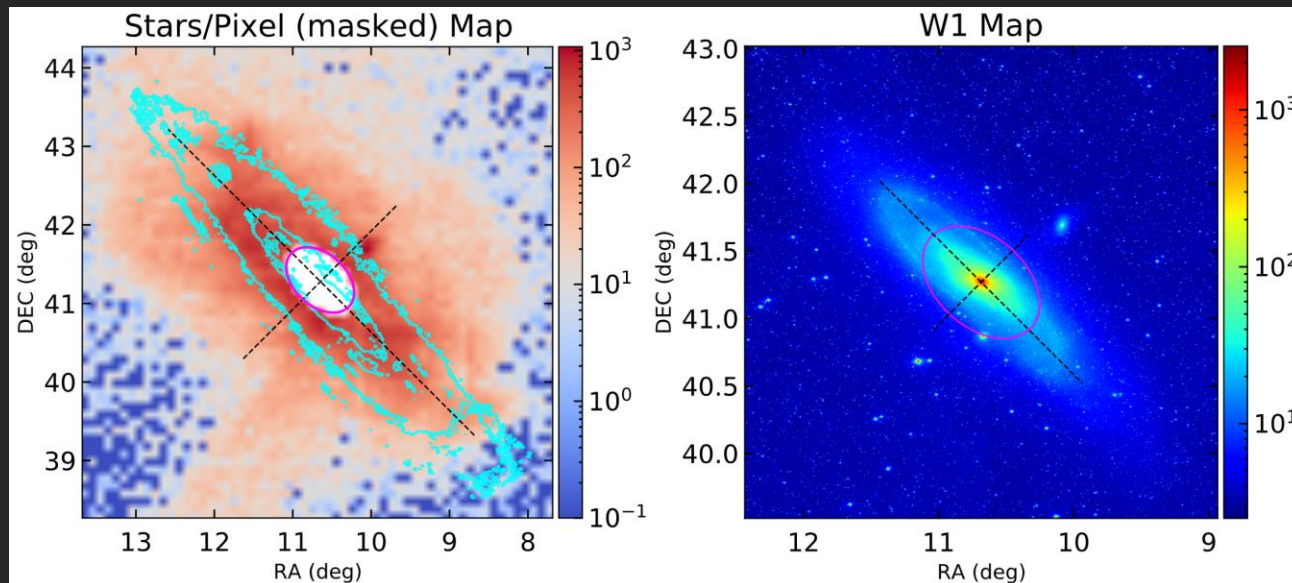
The mysterious gamma-ray excess of Andromeda: Comparing millisecond pulsars to dark matter

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Comparing the Two Leading Hypotheses

Millisecond Pulsars

- Templates for this hypothesis specifically constructed for this region of the sky
- Based on stellar and infrared observations
- Tracing the millisecond pulsar population with old red giants



Old Red Giants → Millisecond Pulsars

Dark Matter

- Dark matter density with the Navarro-Frenk-White profile

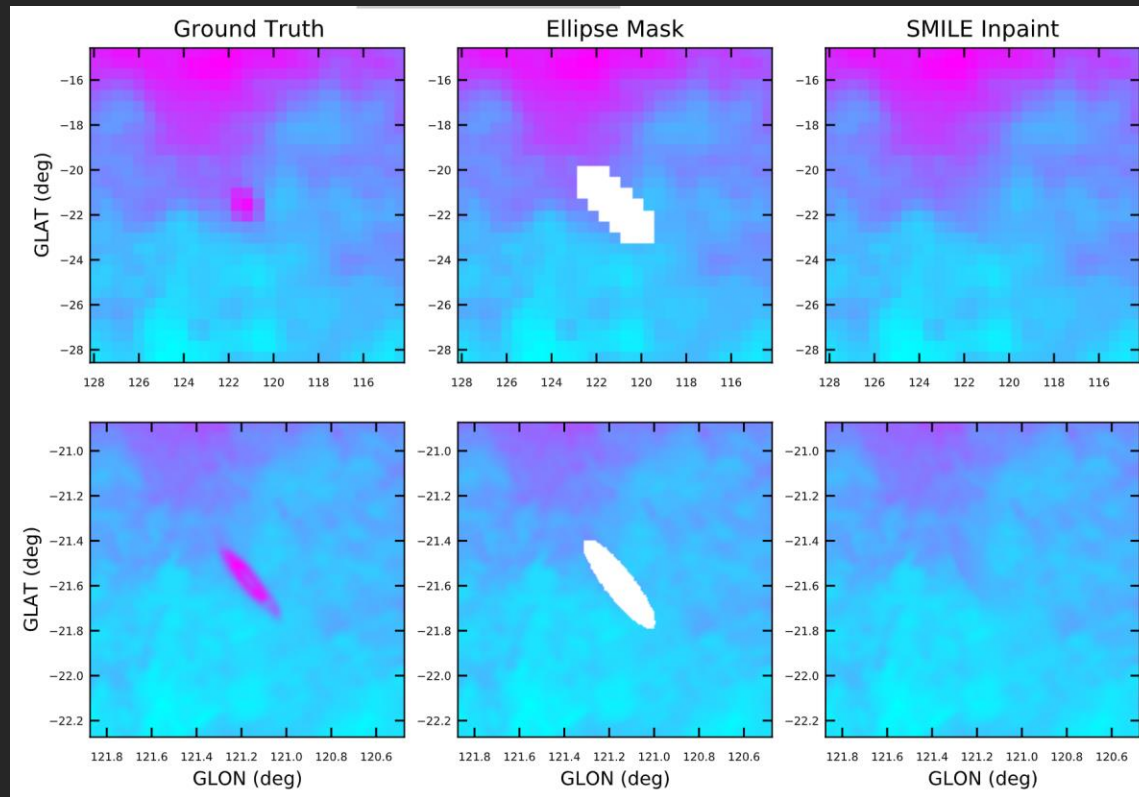
$$\rho(r) = \frac{\rho_0}{\frac{r}{r_s} \left(1 + \frac{r}{r_s}\right)^2}$$

- J-factor as integration over squared density profile over line-of-sight

$$J_p(l, b) = \int_s \rho(r[s, l, b])^2 ds$$

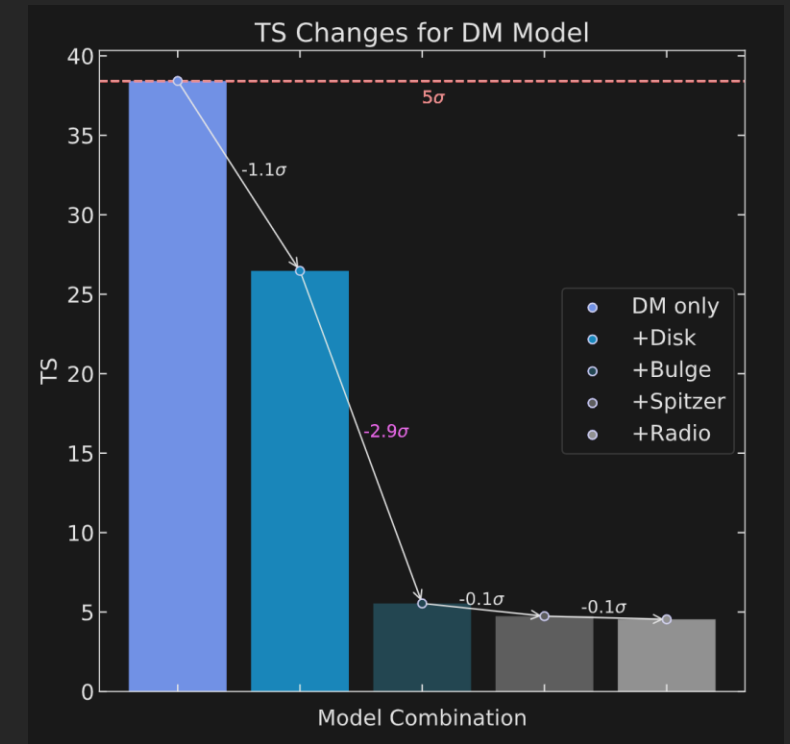
- Both the Milky Way and Andromeda dark matter halo contribute!

Alternative Backgrounds & Results



➤ Combining all H1, IC and inpainting tools to get alternative backgrounds

$$2 \text{ (H1 components)} \times 3 \text{ (Inpainting Methods)} \times 4 \text{ (Inverse Compton Models)} = 24$$



- Dark matter component unwarranted!
- Flux uncertainties dominated by statistical rather than systematic errors!
- Emission seems to be correlated with stellar mass in the bulge of Andromeda!