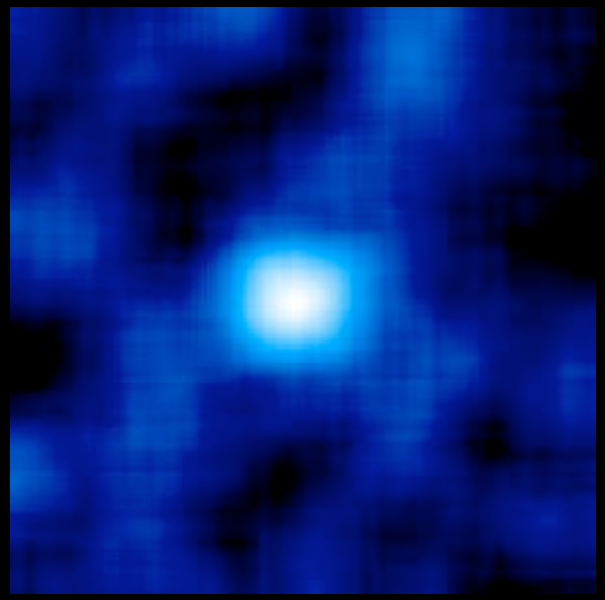
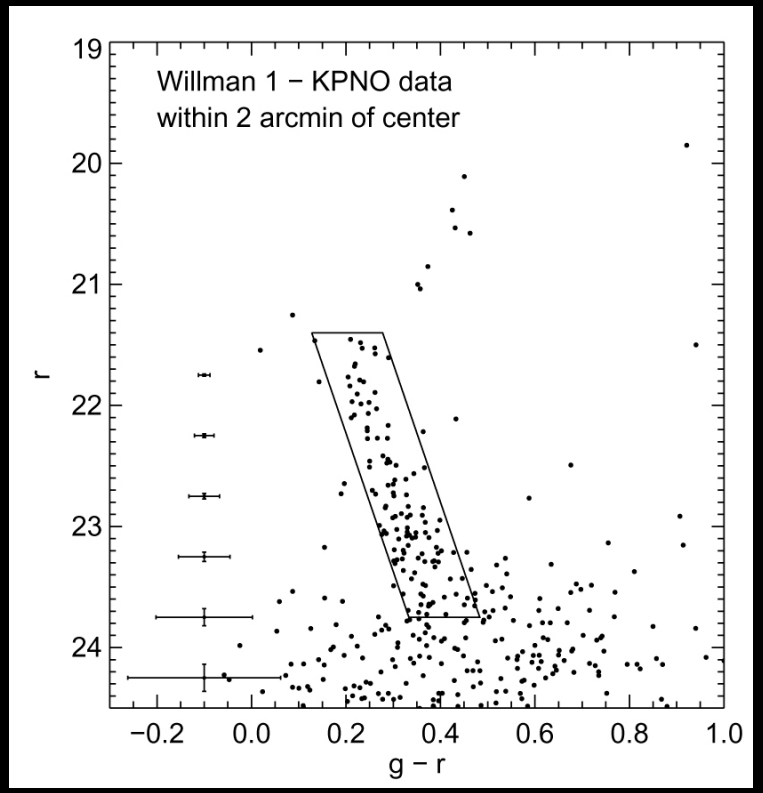
The Most Dark Matter Dominated Galaxies: Predicted Gamma-ray Signals from the Faintest Milky Way Dwarfs

Strigari et al, (2007)



Willman 1 (SDSS)



Overview

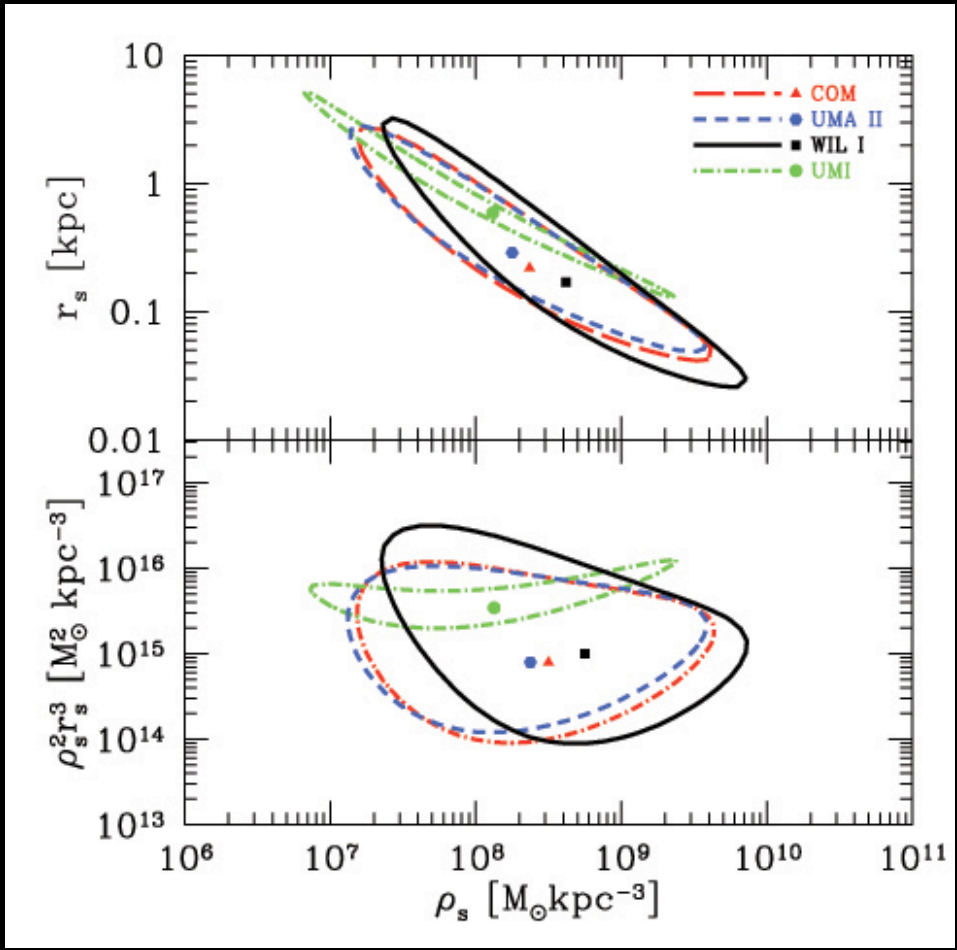
Willman 1, Coma Berenices (Coma) and Ursa Major II are promising targets for γ-ray detection

- among closest dark matter dominated systems
- expected to be free from intrinsic γ-ray emission
- present data on their stellar kinematics suggest that their DM halos are as massive as the more well-known population of Milky Way satellites.

dSph	Distance (kpc)	Luminosity (10^3 $L_\odot$)	Core Radius (kpc)	Cut-off Radius (kpc)	Number of stars
Ursa Major II	32	2.8	0.127 (P)	—	20
Coma Berenices	44	2.6	0.064 (P)	—	59
Willman 1	38	0.9	0.02 (K)	0.08 (K)	47
Ursa Minor	66	290	0.30 (K)	1.50 (K)	187

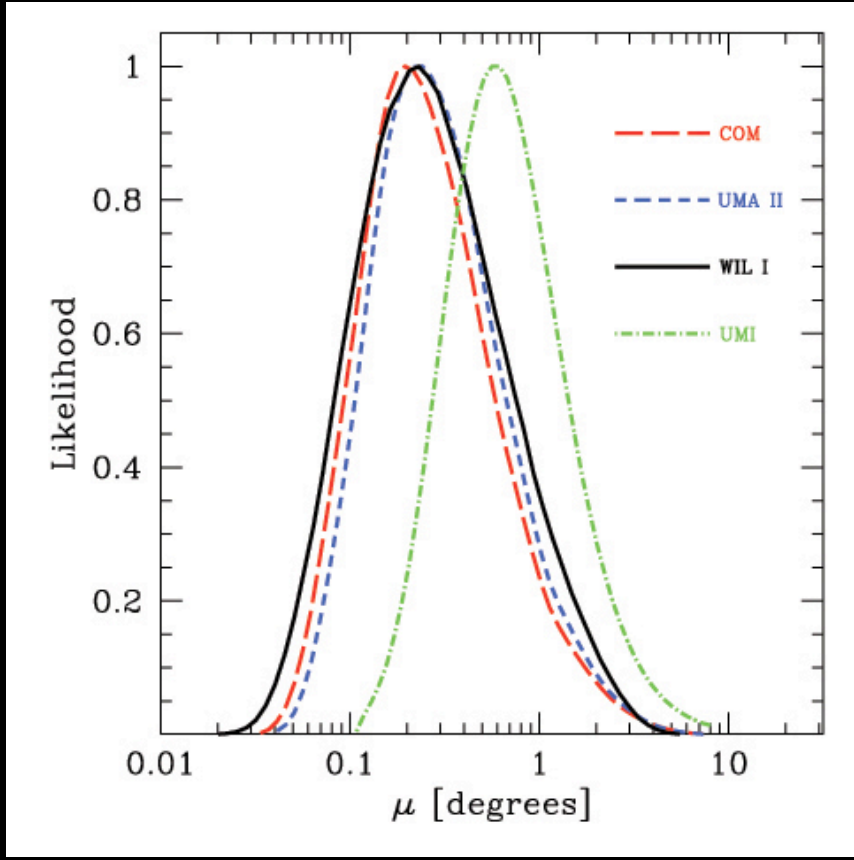
Flux Estimates for Smooth DM Distributions

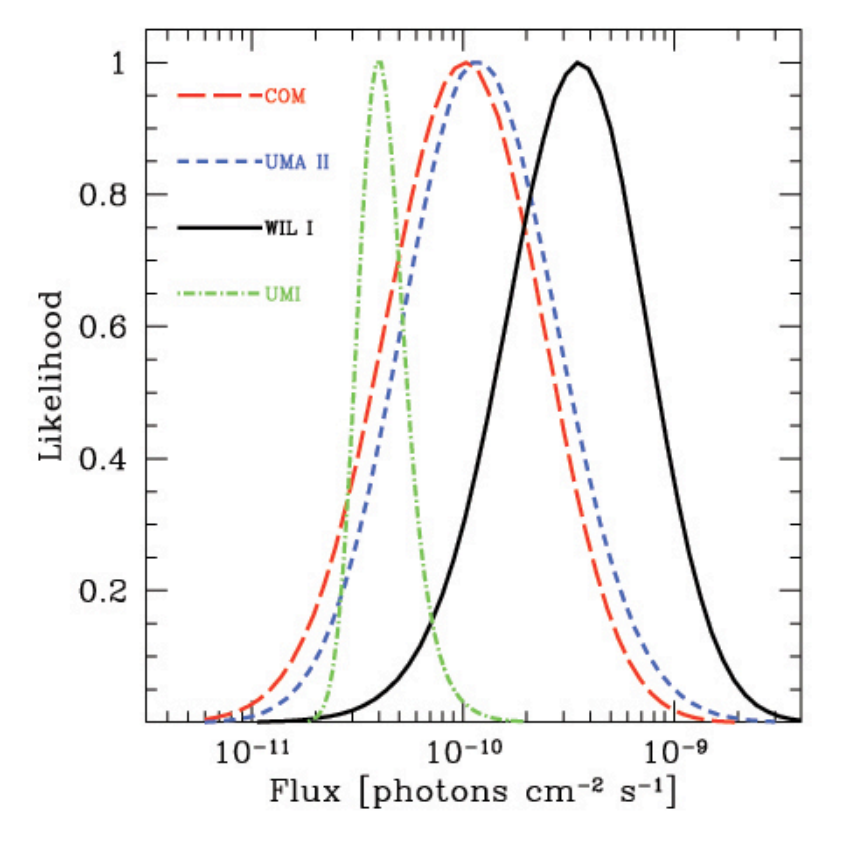
$$\Phi = \frac{\rho_s^2 r_s^3}{D^2}$$



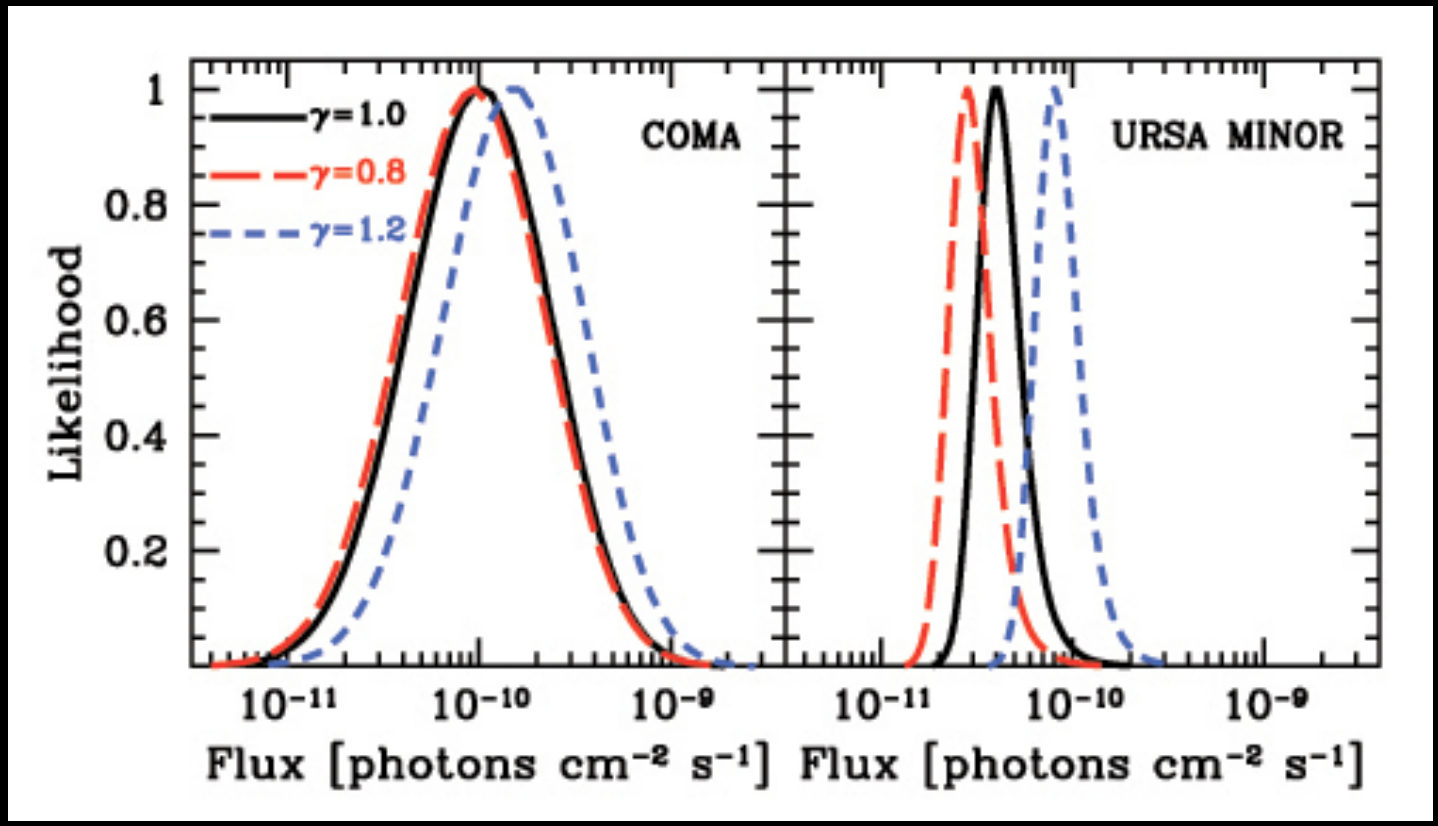
$$P(\vec{\mathbf{x}}|\vec{\theta}) = \prod_{i=1}^{n} \frac{1}{\sqrt{2\pi(\sigma_{t,i}^2 + \sigma_{m,i}^2)}} \exp\left[-\frac{1}{2}\frac{(v_i - u)^2}{\sigma_{t,i}^2 + \sigma_{m,i}^2}\right]$$

Probability Distributions





Effects of Inner Slope



- The expected flux from these three dwarf galaxies is larger than the flux from any pre-SDSS dwarfs

- The mass-to-light ratios of these new dwarfs are ~1000, making them the most DM dominated galaxies in the Universe

- Equilibrium models provide adequate descriptions of the dynamics of each system as can be seen by simulations for γ = 1, 1/2. However, as we approach the core, γ approaches zero.