Cusp or core? The inner slope of the dark matter profile in NGC 1407

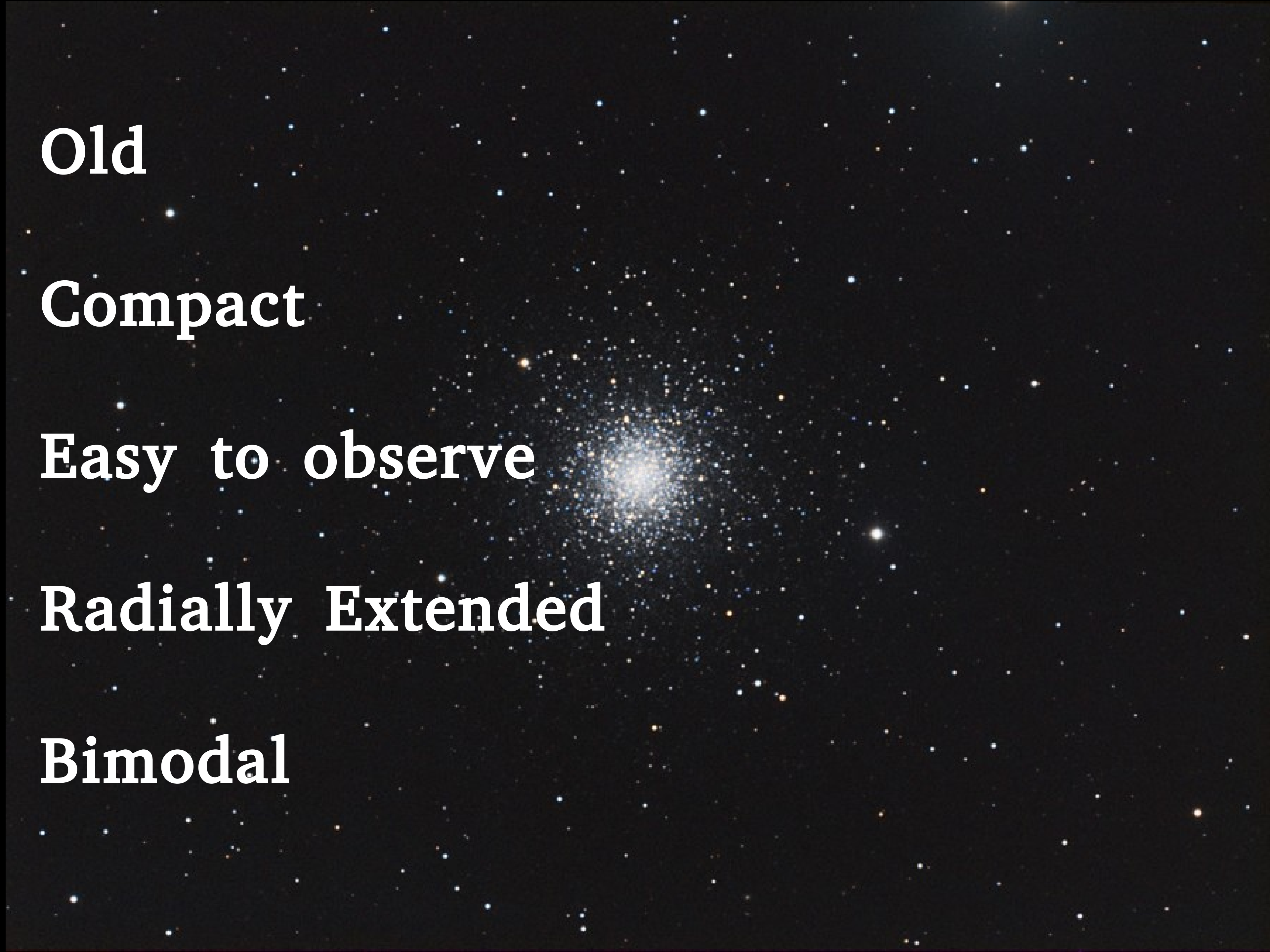
Vincenzo Pota &
the SLUGGS survey

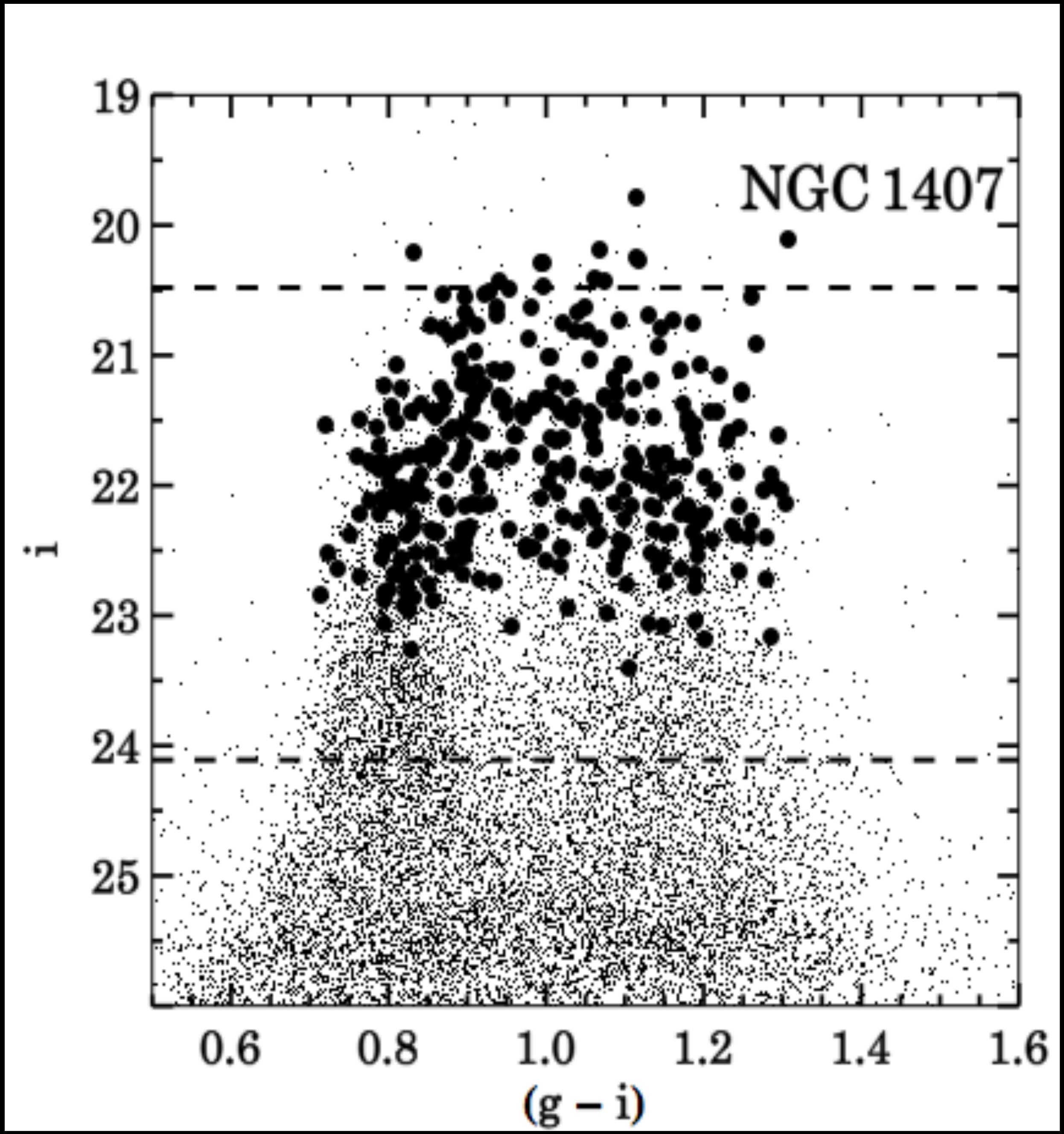
UCSC

SLUGGS

sluggs.swin.edu.au

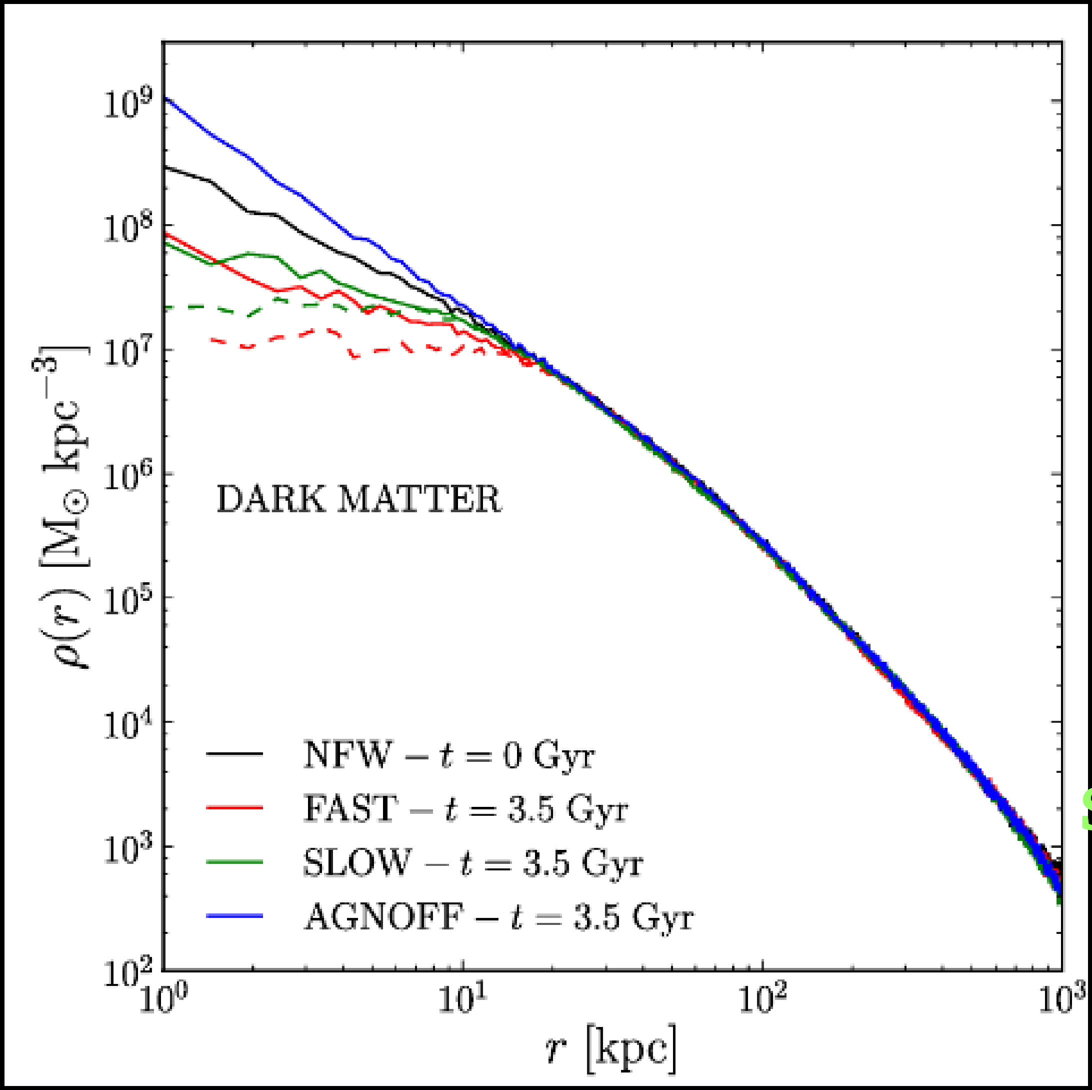
Brodie et al. 2014


Old
Compact
Easy to observe
Radially Extended
Bimodal



Pota et al. 2013

What is the inner slope of the dark matter profile in elliptical galaxies?



$$M_{\rm tot}(r) = M_*(r) + M_{\rm d}(r)$$

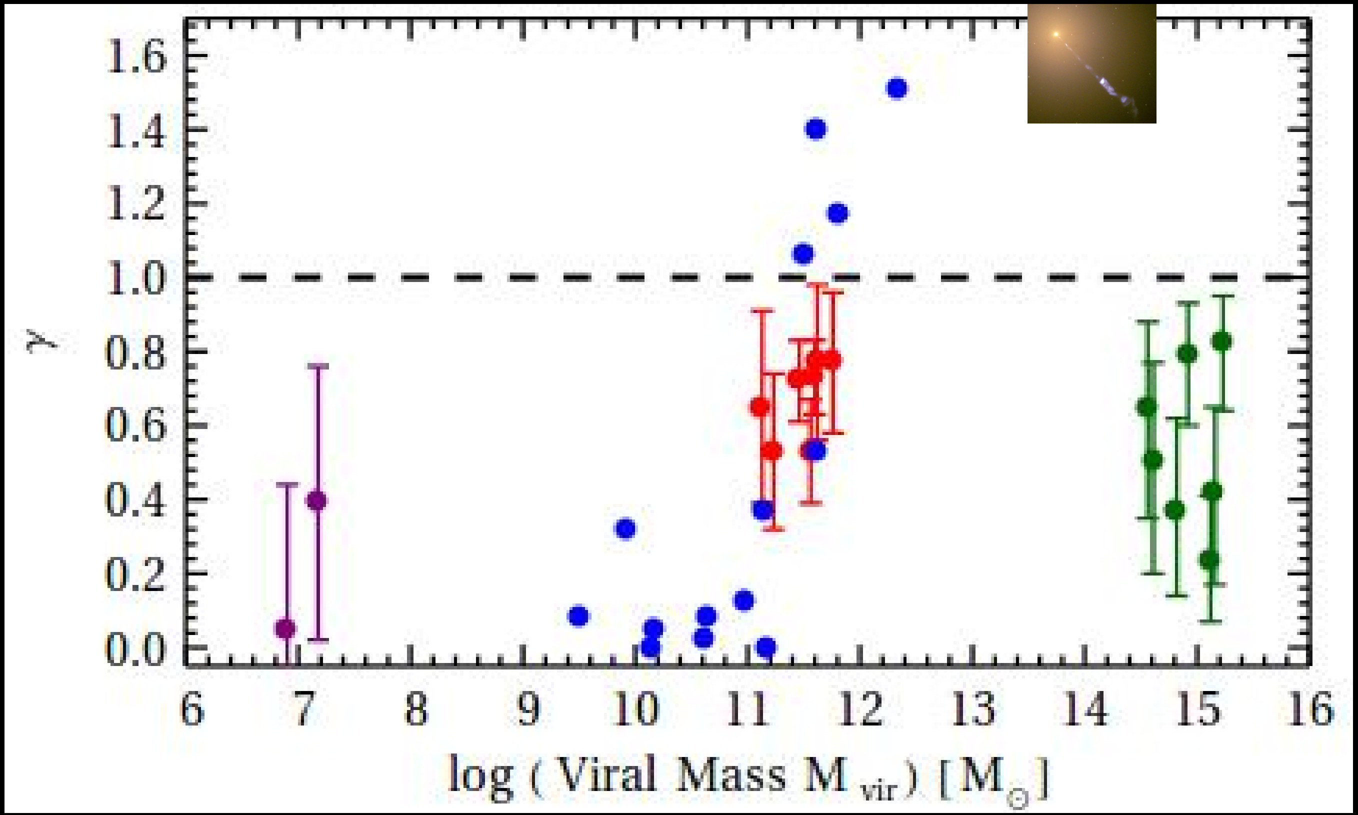
AGN feedback
Martizzi et al. 2013

Supernova feedback
Penarrubia et al. 2012

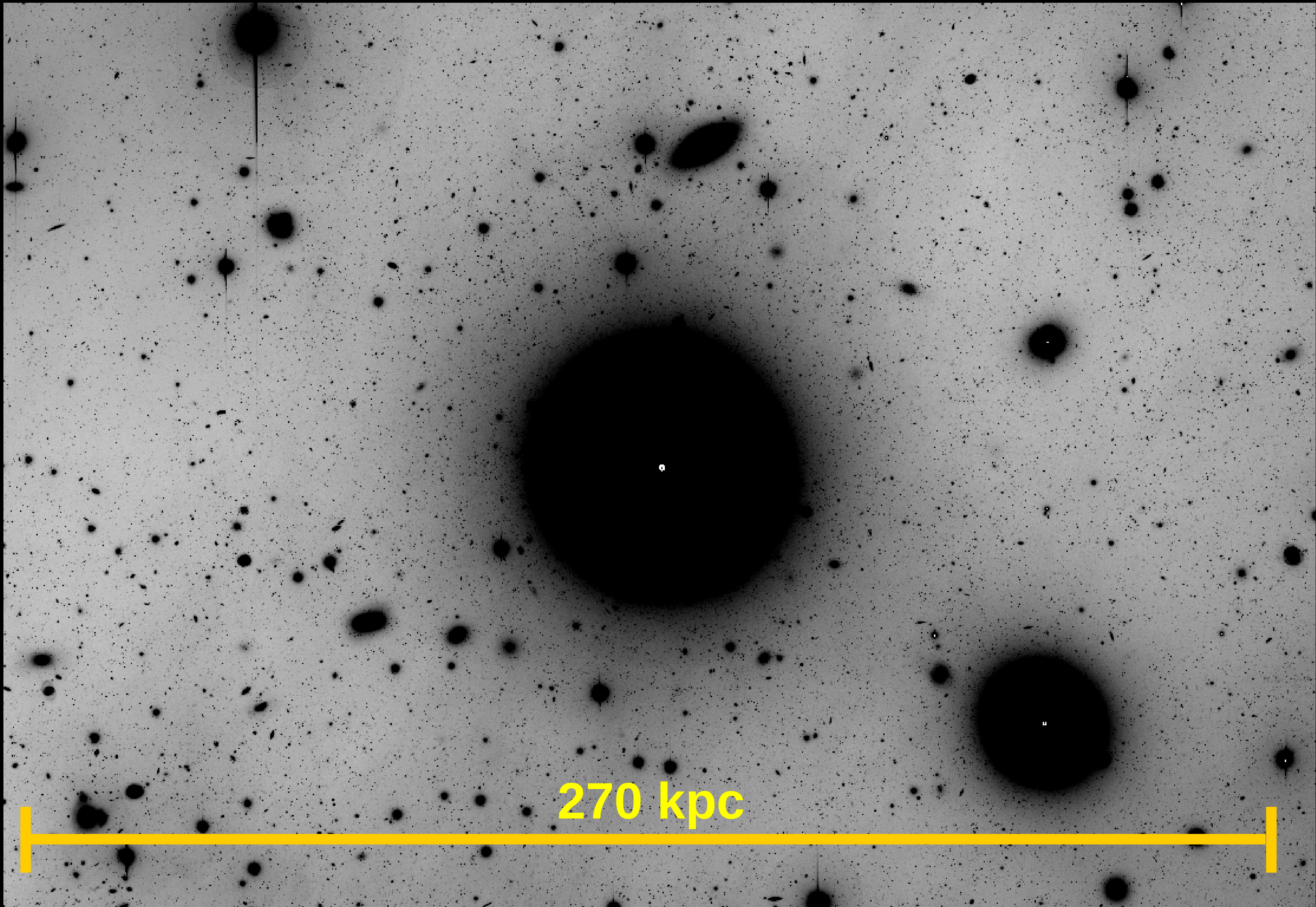
Self-Interacting dark matter
Rocha et al. 2013

Relatively easy in dwarf galaxies

$$M_{\rm tot}(r) = M_*(r) + M_{\rm d}(r)$$



NGC1407 hosts a central AGN (Giantucci et al. 2012)



The problem is very degenerate

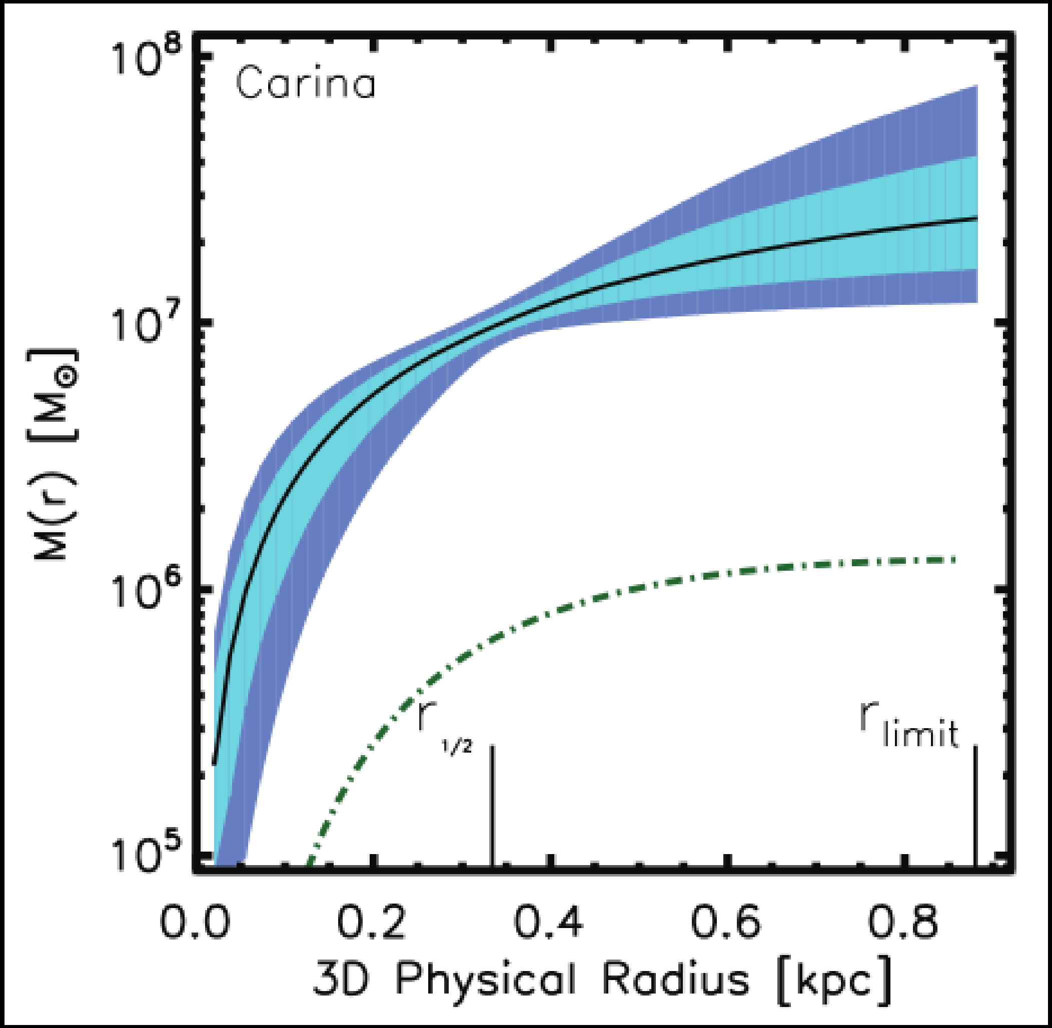
$$\frac{\mathrm{d}}{\mathrm{d}r}(\nu\sigma_r^2) + \frac{2\beta(r)}{r}\nu\sigma_r^2 = -\nu\frac{GM_{\mathrm{tot}}(r)}{r^2}$$

Mass – anisotropy degeneracy

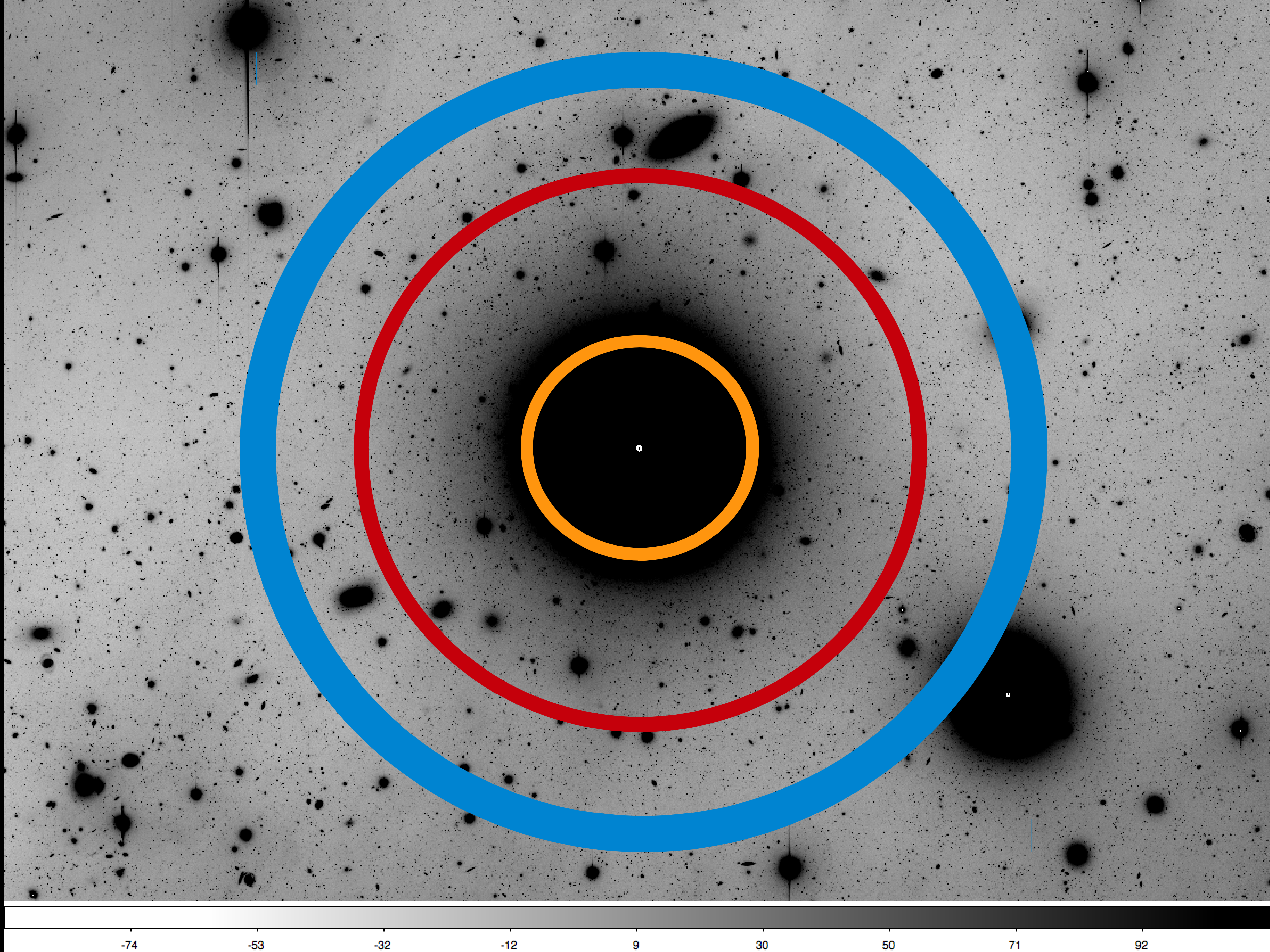
$$M_{\mathrm{tot}}(r) = M_*(r) + M_{\mathrm{d}}(r)$$

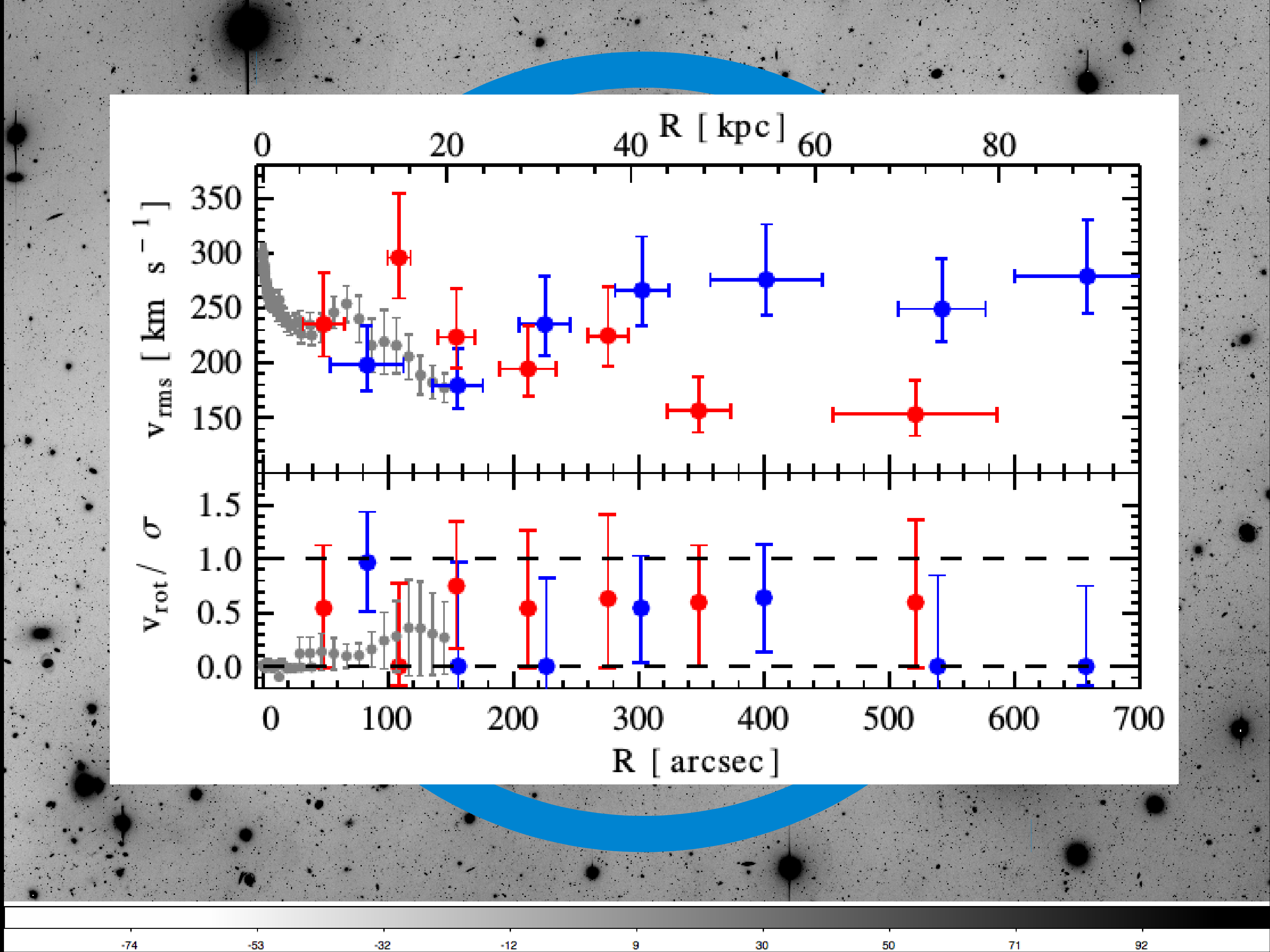
Luminous – dark mass degeneracy

Uncertainties are minimized at the sweet spot



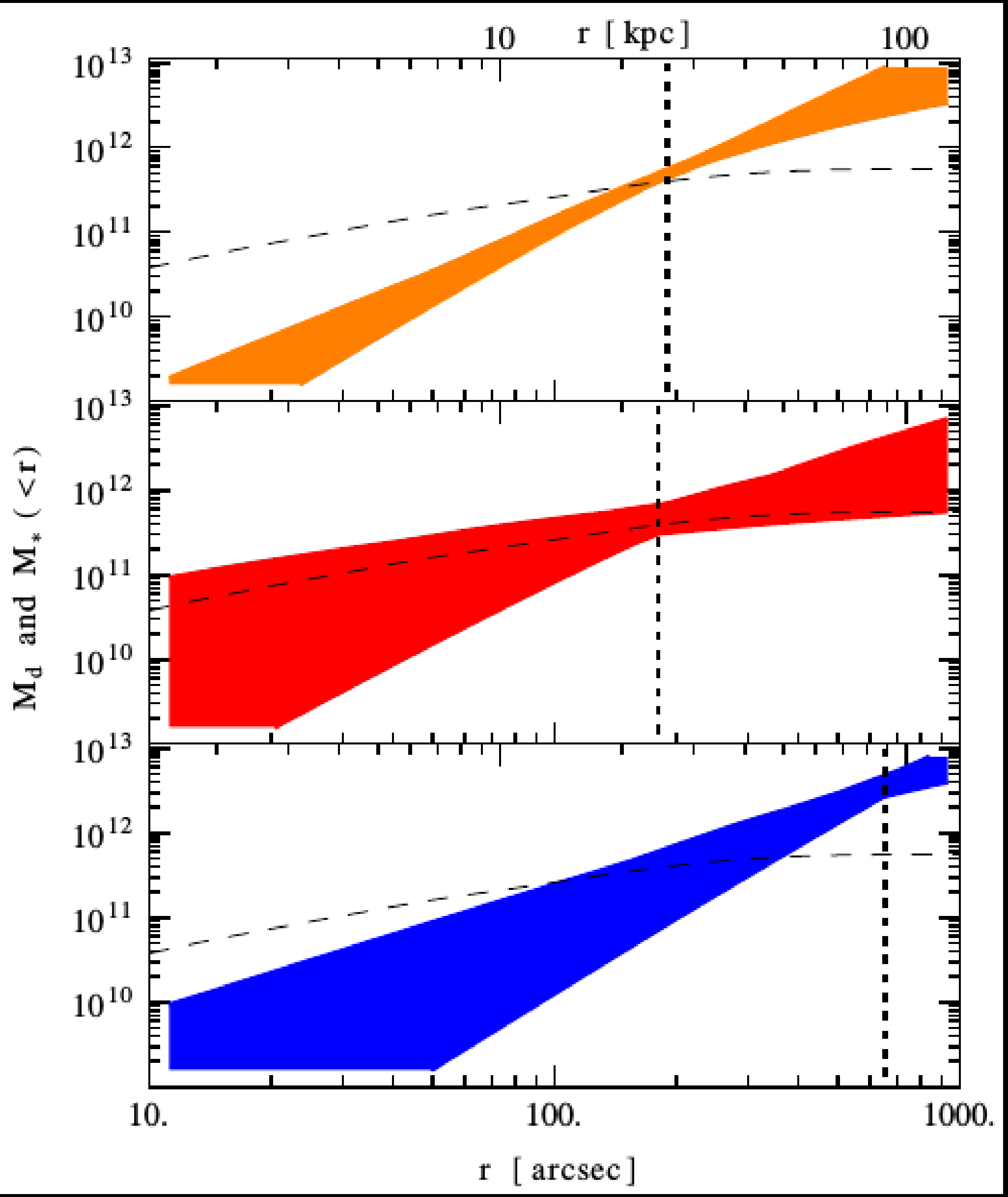
Wolf et al. 2010


-74
-53
-32
-12
9
30
50
71
92

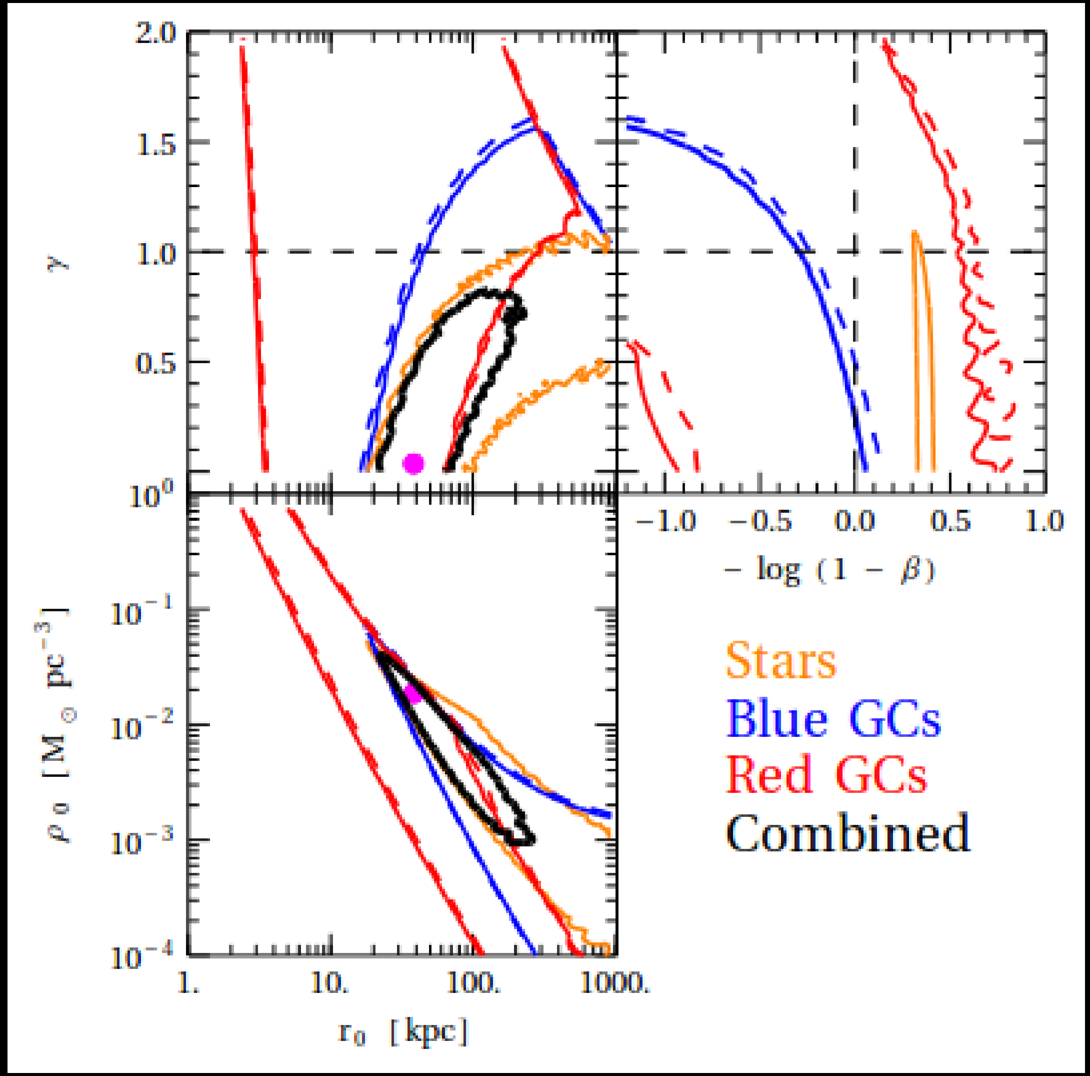


R [kpc]
0
20
40
60
80
350
300
250
200
150
v_rms [km s^-1]
1.5
1.0
0.5
0.0
v_rot / σ
0
100
200
300
400
500
600
700
R [arcsec]
-74
-53
-32
-12
9
30
50
71
92

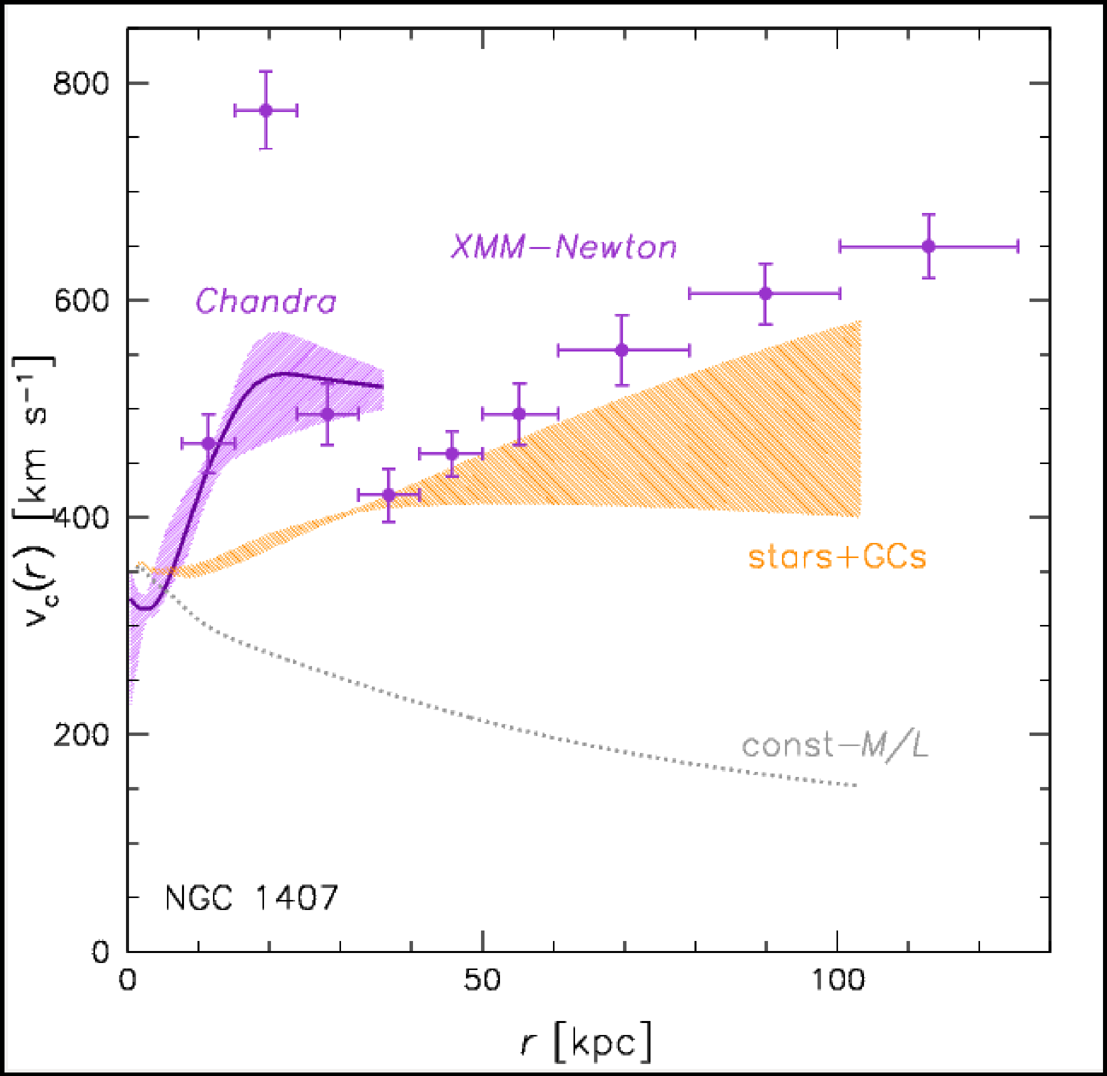
The sweet spots of NGC 1407



$$\nu_d(r) = \rho_0 \left(\frac{r}{r_0}\right)^{-\gamma} \left[1 + \left(\frac{r}{r_0}\right)\right]^{\gamma-3}$$



Comparison with X-ray data (Su et al. 2014)



Pros

→ It breaks degeneracies
(Schuberth+10,Napolitano+14, Agnello+14, Lukas+04)

→ It can measure cusps and cores

Cons

→ It is too sensitive on the stellar mass.

→ Needs very accurate surface brightness profile.