

Milky Way Rotation Curve

Sam Grobelny, Sacha Wible, Wentao Zhong

Methods & Assumptions

$R \leq 30$ kiloparsecs

Bulge

$M = 10^{10}$ solar masses

$1 \leq R \leq 30$ kiloparsecs

Disk, approximated as a disk

$M = 10^{11}$ solar masses

$1 \leq R \leq 10$ kiloparsecs

Calculations

Orbital velocity = $\sqrt{GM/R}$

Enclosed mass of disk = $\pi * R^2 * \text{density}$

The Graph

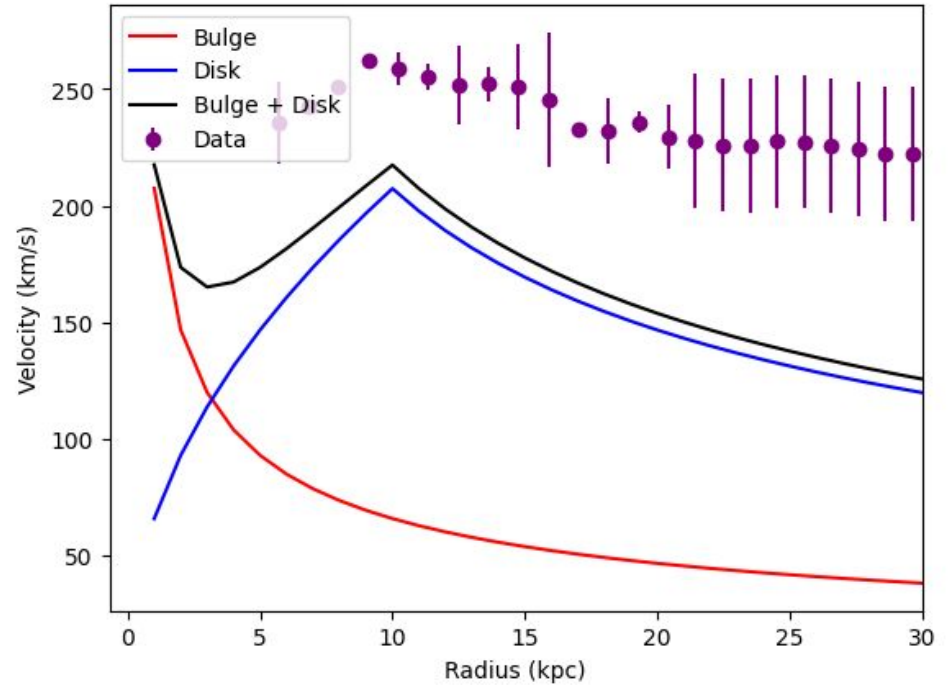
using the assumed values and approximations we find this graph

data

measuring the rotational velocity of M31

comparable to the Milky Way under radius of 50KPC

comparing our approximations with the collected data we appear to be missing something



Methods & Assumptions 2

Halo, approximated as a sphere

$M = 10^{12}$ solar masses

$1 \leq R \leq 30$ kiloparsecs

Calculations

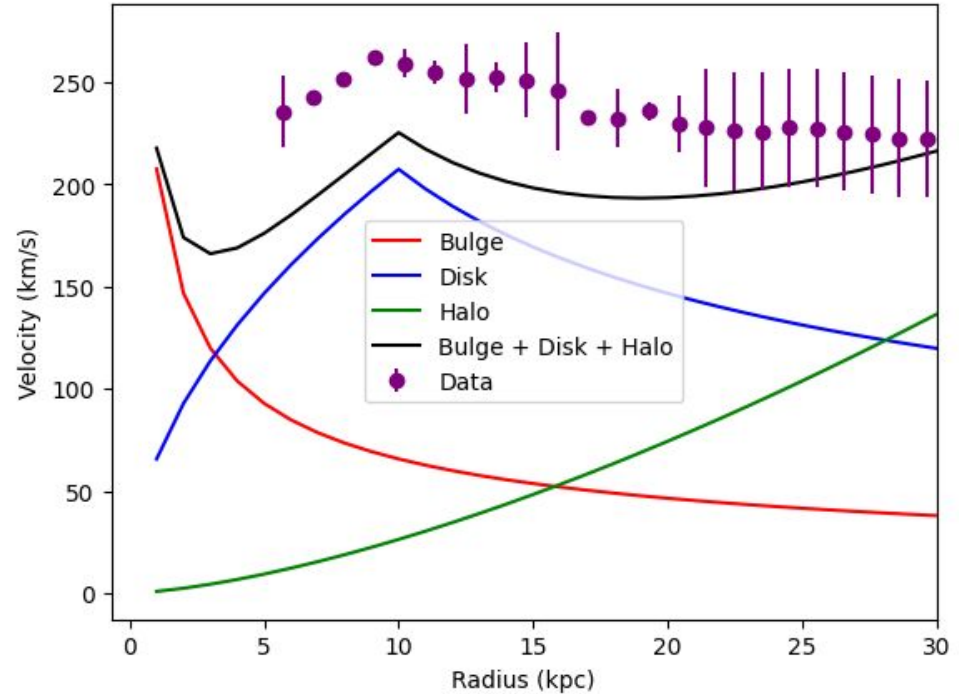
Volume of sphere = $\frac{4}{3} * \pi * R^3$

Enclosed mass of sphere = $\frac{4}{3} * \pi * R^3 * \text{density}$

The Final Graph (With Data)

includes the halo, which is not classically observable

indicates dark matter, as the rotational curve better matches the collected data when dark matter is accounted for



Works Cited

Carignan, Claude, et al. "The extended HI rotation curve and mass distribution of M31." *The Astrophysical Journal*, vol. 641, no. 2, 30 Mar. 2006, <https://doi.org/10.1086/503869>.