Galaxy Dynamics
Rotation Curves and Dark Matter

Extragalactic Astronomy Group

November 24, 2025

Abstract

Analysis of galaxy dynamics including rotation curves, dark matter profiles, and scaling relations.

1 Introduction

Galaxy rotation curves provide evidence for dark matter.

2 Rotation Curve Components

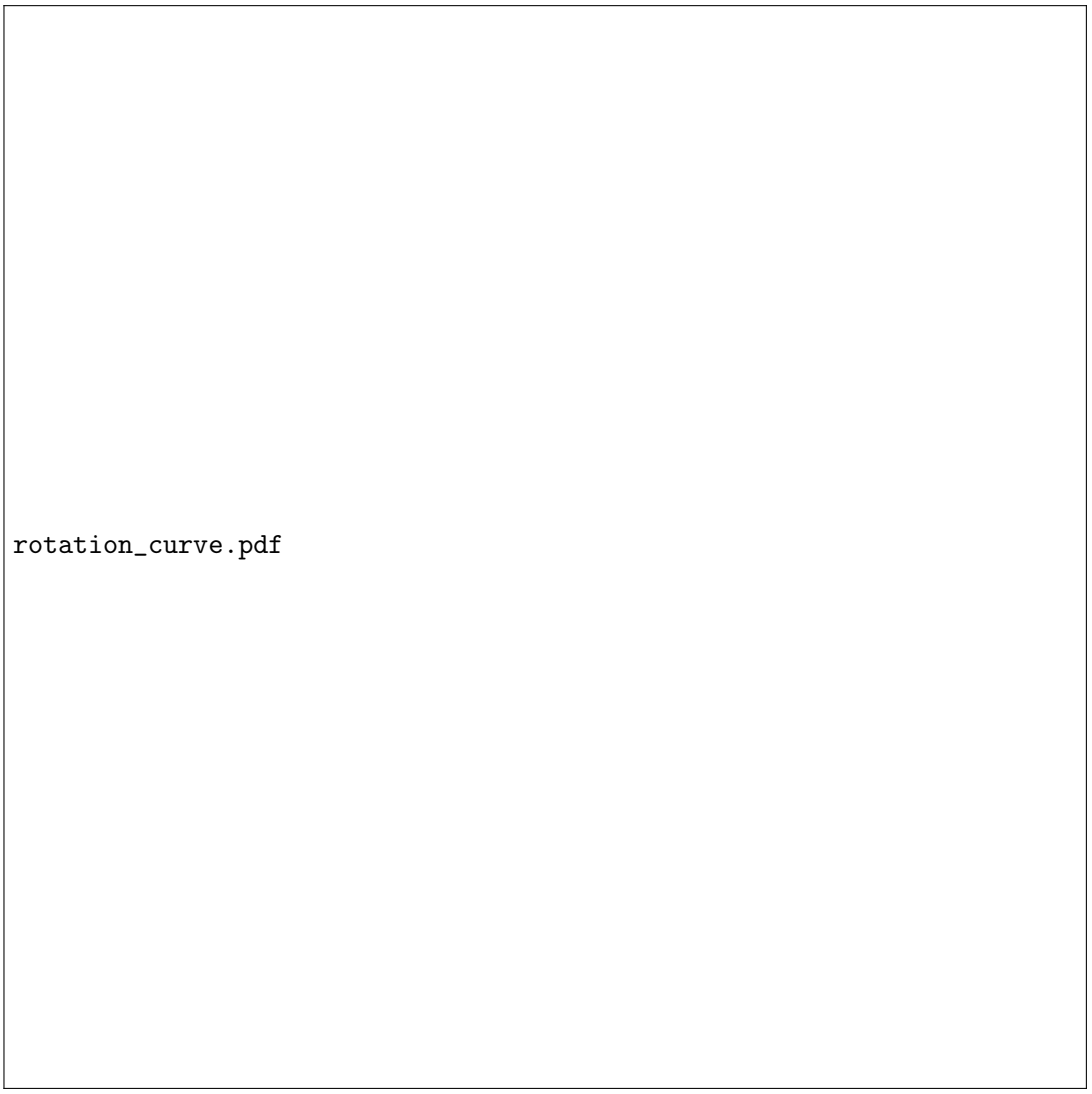

Figure 1: Rotation curve decomposition showing different components.

3 NFW Profile

$\rho(r) = \frac{\rho_s}{(r/r_s)(1+r/r_s)^2}$

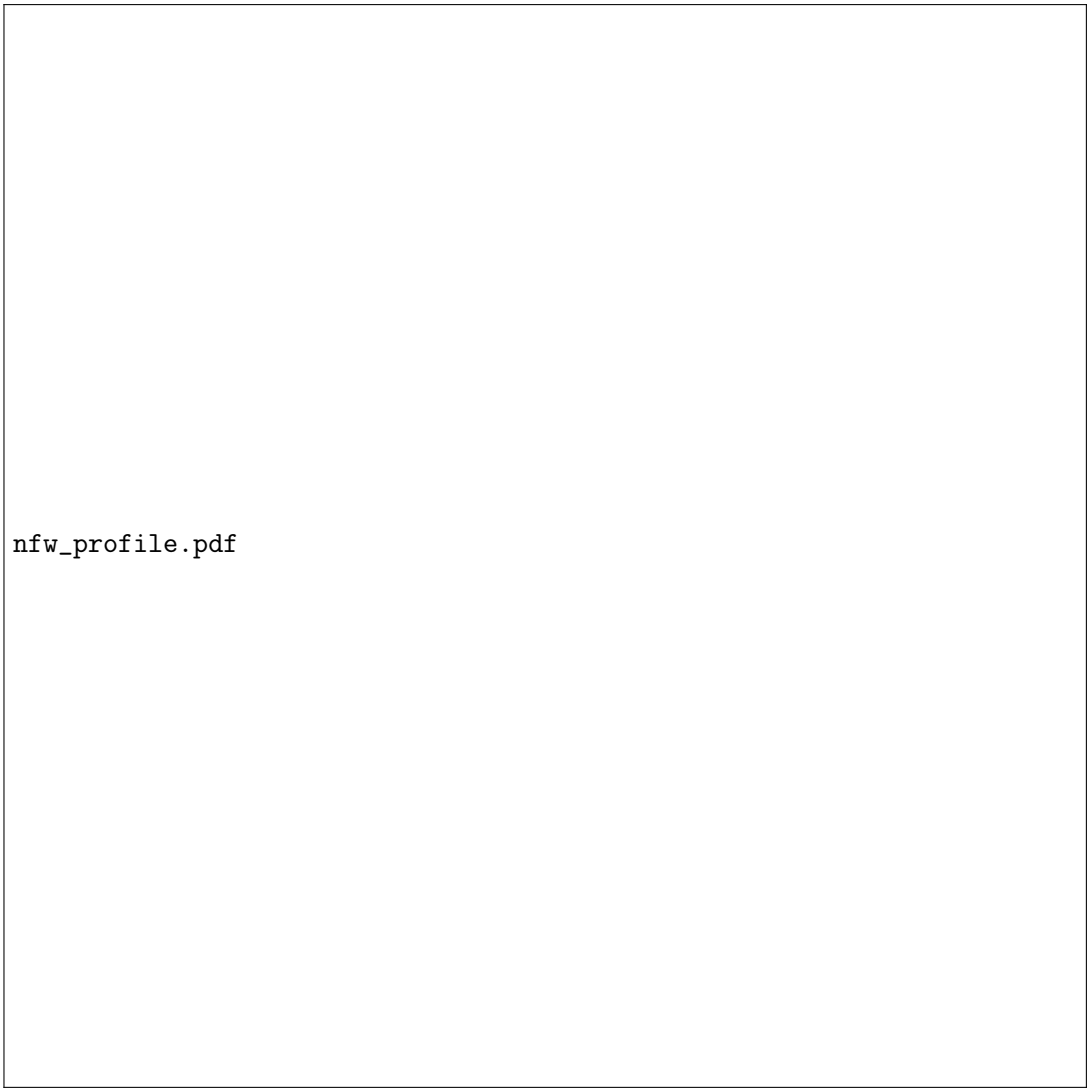

Figure 2: NFW density profiles for different concentrations.

4 Tully-Fisher Relation

$M_B = a \log_{10} V_{max} + b$

Figure 3: Tully-Fisher relation for spiral galaxies.

5 Dark Matter Fraction

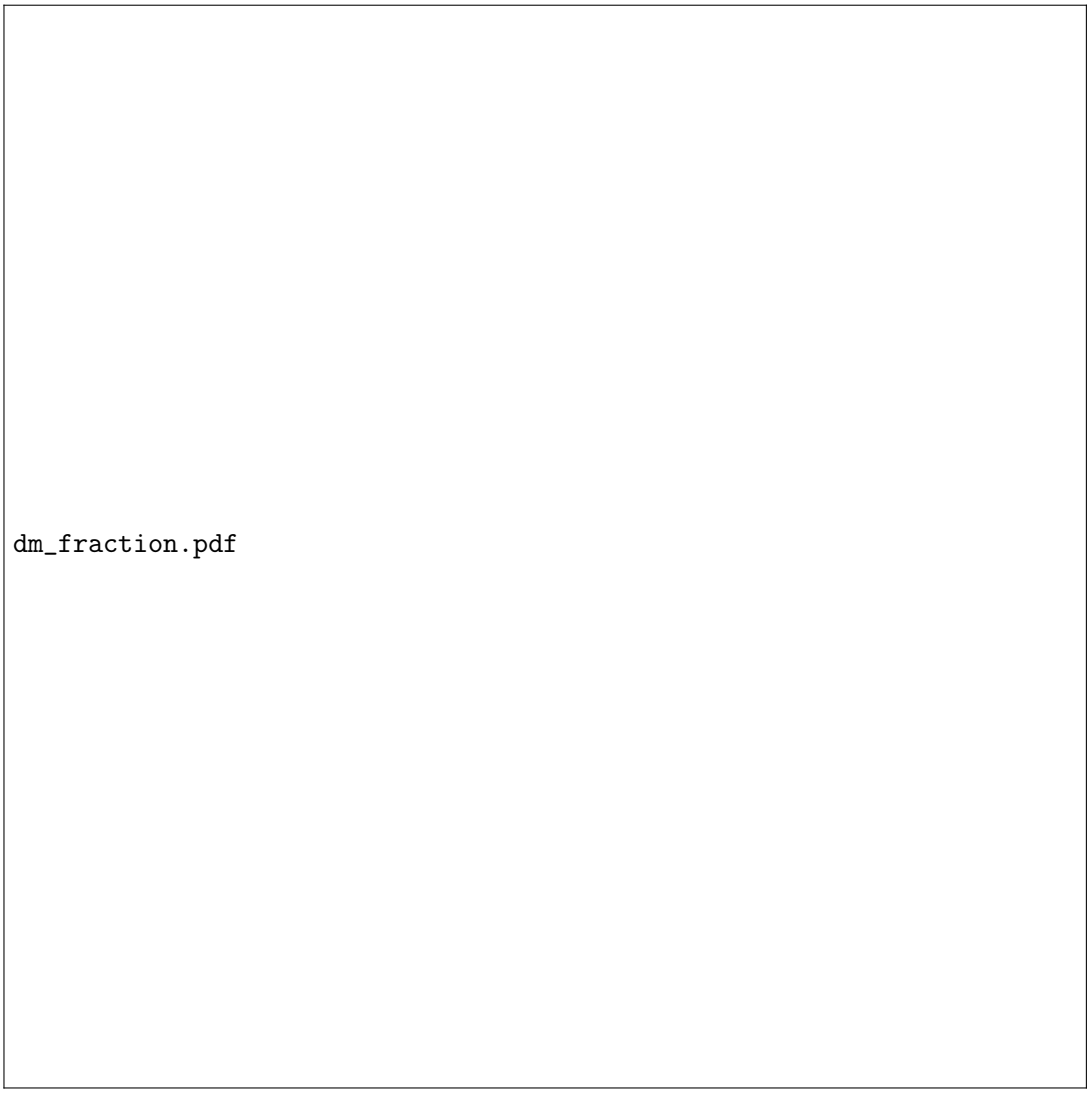

Figure 4: Dark matter fraction vs radius.

6 Velocity Dispersion

Figure 5: Velocity dispersion profile.

7 Mass Modeling

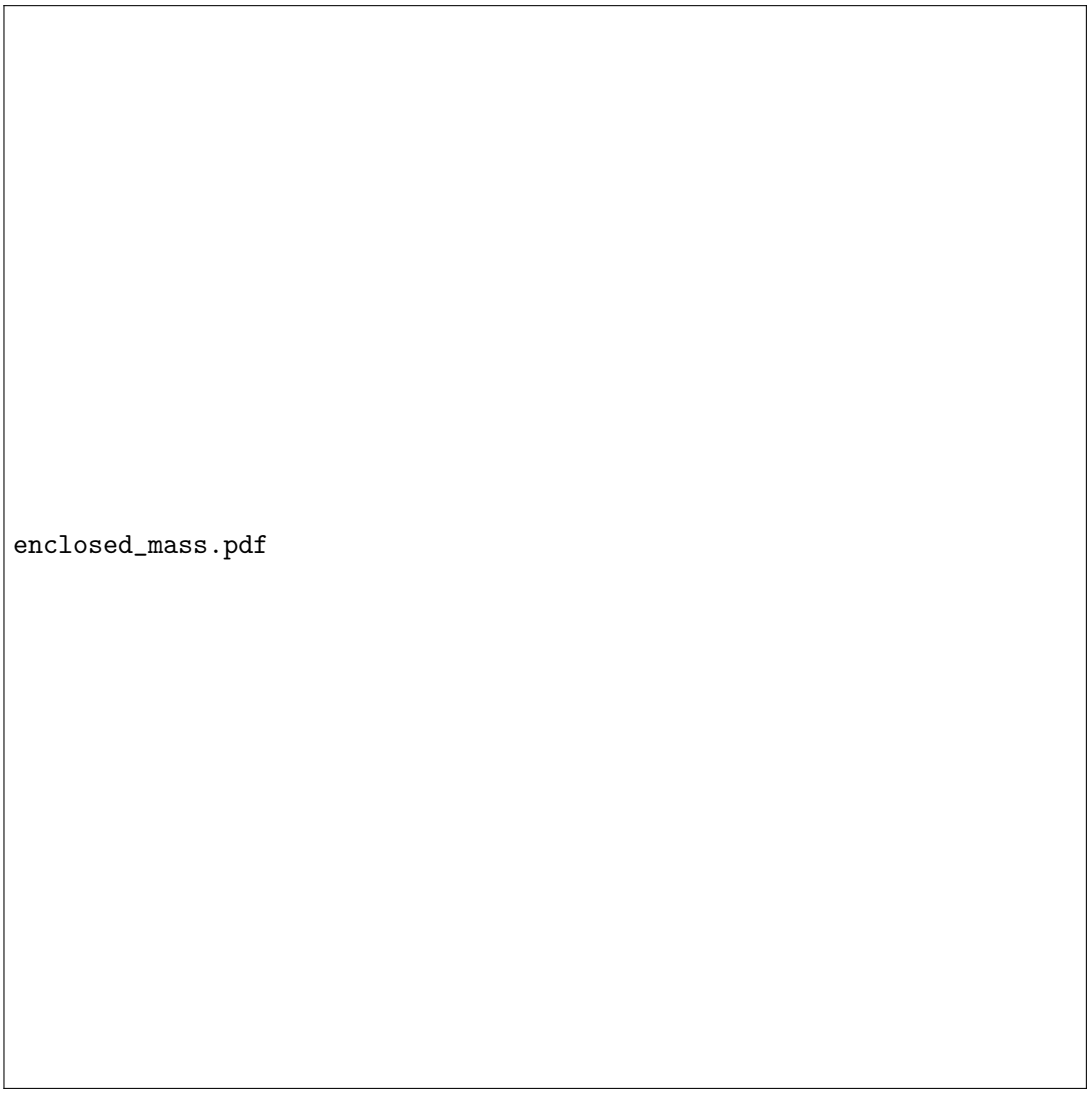

Figure 6: Enclosed mass profile.

8 Results

9 Conclusions

Galaxy rotation curves require dark matter halos to explain observations.