Dark matter content of gas-rich dwarf galaxies

Level: Honours

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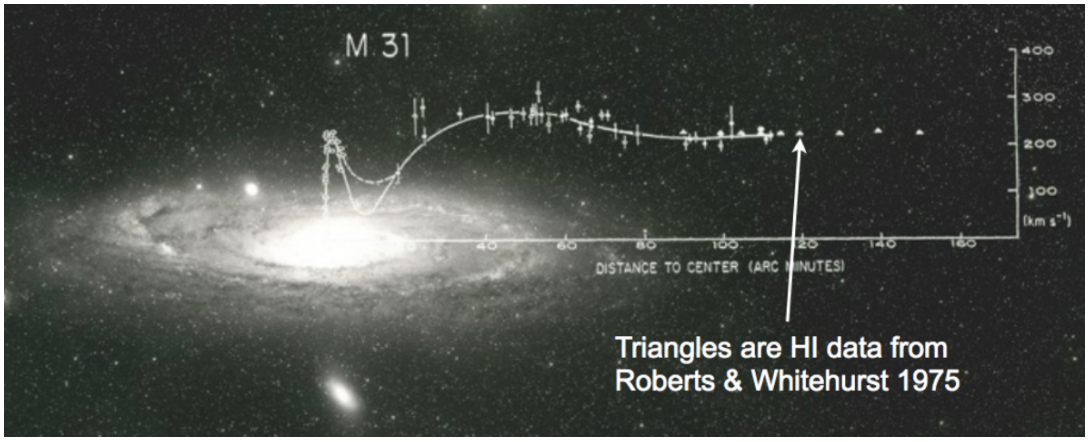
Project Background

A century ago, Jan Oort and Fritz Zwicky uncovered discrepancies in galactic motions that hinted at some form of non-luminous matter. Vera Rubin and Kent Ford's groundbreaking work on the Andromeda Galaxy (M31) in the 1970s later confirmed its dominance in galaxies. These authors found through optical spectroscopy that the velocity rotation profile remained flat even in the outskirts of M31 where starlight was diminished and inferred what is generally known today as dark matter. Yet, its nature remains one of astronomy's greatest mysteries. Recent observations of "dark matter–deficient" galaxies challenge existing theories, offering a unique opportunity to refine our understanding of galaxy formation and cosmology.



Rotation curve showing the flat velocity profile in the outskirts of the Andromeda Galaxy (> 80 arcmin) where starlight is very faint. Data from the kinematic tracers (HII – ionized gas; HI – neutral gas) available in the outer part of M31 provide a very clear evidence for presence of non-luminous matter – dark matter – that extends further out than the stars. Image Credit: Joel Primack

Project Description

Join this project to pioneer cutting-edge research using optical spectroscopic data from the 10-meter South African Large Telescope (SALT)—the largest in the Southern Hemisphere. You will:

- Analyse newly acquired spectral data from SALT's Robert Stobie Spectrograph (RSS).
- Quantify dark matter in nearby dwarf galaxies, testing its alleged absence in some systems.
- Master industry-standard software and Python coding to model kinematic tracers (e.g., HI/HII gas).

Why This Project?

- Publishable Results: Contribute to an ongoing collaboration with potential for journal publication.
- Skill Development: Gain hands-on experience with professional astronomical data and computational tools.
- Legacy: Follow in the footsteps of giants like Rubin and Zwicky while addressing modern cosmological debates.

Requirements

- Basic Python skills (or willingness to learn) and enthusiasm for Astrophysics. No prior spectroscopy experience needed–training provided!