Testing the method of measuring inclination angles of disk galaxies
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Introduction

- Determining accurate inclination angles of disk galaxies is important when accounting for projection effects and dust extinction.
- The inclination angle can be derived from Hubble's equation (Hubble, 1926):
\[
\cos^2\ i = \frac{q^2 - q_0^2}{1 - q_0^2}
\]
- This equation assumes the disk is circular when viewed face on and assumes a finite intrinsic thickness $q_0$

Methods

- Select disk galaxies
- Use synthetic images of galaxies from the TNG50 simulation (Nelson et al. 2019) to determine the observed inclination angle
- Compare to the intrinsic inclination angle derived from the stellar angular momentum vector of the galaxy

Results

At low intrinsic inclination angles, the observed inclination angle is higher than the intrinsic inclination angle.

At high intrinsic inclination angles, the observed inclination angle is lower than the intrinsic inclination angle.

Conclusions

- The $q_0$ assumption generally has a small effect on the accuracy of inclination angle measurements except at high inclination angles.
- At higher inclination angles, the presence of bulges, halos and other kinematically hot components results in underestimates of the ellipticities resulting in the observed inclination angle being lower than the intrinsic inclination angle.
- At lower inclination angles, the observed inclination angle is higher than the intrinsic inclination angle. This is due (at least in part) to the assumption that disks are circular when viewed face on.