

Galactic Astrophysics (PhD Qualifying Exam, 2014)

- (1) A complete description of an ensemble of collisionless particles is via the distribution function f . What variables does the distribution function depend on? (10%) What is the equation describing the evolution of f ? (10%) In a force balance equilibrium, what is the solution for f ? (10%)
- (2) What are the Tully-Fisher relation (5%), the Jackson-Faber relation (5%), and the fundamental plane (10%)?
- (3) In a uniformly rotating thin sheet of uniform density that is assumed to be in force equilibrium, under what condition will the disk be completely stable? Please derive your result (25%).
- (4) From the momentum conservation law of collisionless particles in spherical coordinate, one can derive the dynamical importance of the velocity anisotropy parameter β . Please derive such a momentum equation in the spherical coordinate (15%). In a situation when the particle random velocity is all along the radial direction, how will the required self-gravity be different from the situation when the particle random velocity is isotropic? (10%)