

Qualification Examination—Galactic and Extragalactic Astronomy
May 27, 2016

1. Please write down at least five major emission mechanisms for astronomical objects, and for each emission mechanism please list one extragalactic object/component, which can be observed with the corresponding emission. (10 points)
2. What is the Malmquist bias? How can you avoid it when you analyze your data? (10 points)
3. Distance:
 - (a) How can we measure the distance to some nearby galaxies, such as M31? (5 points)
 - (b) How can we measure the distance to globular clusters in the Milky Way? (5 points)
 - (c) How can we measure the distance to the centre of the Milky Way? (5 points)
 - (d) What are the angular diameter distance and the luminosity distance? (5 points)
4. Milky Way:
 - (a) What is the Local Standard of Rest? (5 points)
 - (b) Derive the relations of Oort constants and the tangential and the radial velocities of stars in local Galactic plane. (10 points)
5. ISM:
 - (a) Please discuss why most of the atomic and the ionised gas of ISM only exist in some particular phases (i.e., particular temperatures). (10 points)
 - (b) What and why do atomic gas and molecular gas behave very differently when galaxies merge? (10 points)
6. Please describe and compare the Tully-Fisher relation and the Faber-Jackson relation. (10 points)
7. The dark side of Universe:
 - (a) What is dark matter? (5 points)
 - (b) What is dark energy? (5 points)
 - (c) How do people know the existence of the dark matter and dark energy? (5 points)