PHY306 QUESTIONS FOR CURTIS 1920

Answer all questions. Some questions may require you to consult other sources: if so, remember to reference the sources used in standard style (see the Department's web page on "Plagiarism and Collusion" for instructions on referencing). Always use your own words, unless there is justification for a brief direct quote—if there is, use quotation marks. This exercise counts 5% towards your total module mark.

1. Curtis' model of the Galaxy is a roughly lens-shaped ensemble of about 10^9 stars, measuring about 10 kpc in diameter and about 1 kpc in thickness, with the Sun near the centre. This is wildly wrong (the model proposed by Shapley in Shapley 1918a is much closer, albeit a bit too large). What has caused this error, and why didn't it affect Shapley's model as badly? [3]

2. Curtis acknowledges that the distribution of the spiral nebulae strongly avoids the region of the Milky Way itself, i.e. the Galactic plane. This was believed by many astronomers of the time to constitute evidence that the spiral nebulae were physically associated with the Galaxy. Why is this? What is Curtis' explanation? [2]

3. Curtis gives a table of "space-velocities" (I suspect he really means Doppler velocities) of different classes of object. Briefly explain why the observed speeds increase with spectral type for stars, and why the velocities of (globular) star clusters are so much higher than the stellar velocities. What arguments does Curtis offer in support of his claim that the high Doppler velocities of the spiral nebulae suggest that they are very distant? [5]

4. Carefully explain, *in your own words*, Curtis' argument that the novae observed in spiral nebulae support the contention that these are distant galaxies, and not nearby objects. [3]

   Novae are still sometimes used as distance indicators: look up the literature, and briefly discuss the main differences between the modern methods and Curtis' estimate. [2]