PHY2003 Assignment 4

Submission of this assignment will be via Canvas. Your completed assignment must be submitted as a scanned PDF file. Advice on submitting scanned solutions can be found on Canvas. Canvas will only accept PDF submissions. You can submit at any time before the deadline without incurring a late submission penalty.

Deadline for submission: 10PM TUESDAY 7th DECEMBER

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1. The Kessel system is in the Outer Rim of a spiral arm, 16 kpc from the galactic centre and is rotating about the galactic centre with velocity 180 km/s. Han and Chewie need to get a shipment to Nal Hutta which is 1.5 kpc closer to the core than Kessel.

   (a) Chewie likes to be prepared. He wants to set the navicomputer, but he needs to work out the angle for the jump. The minimum distance from the galactic centre along their line of sight to Nal Hutta is 12 kpc. What is the galactic longitude between Kessel and Nal Hutta assuming they are at the same latitude? **[5]**

   (b) Travelling through hyperspace ain't like dusting crops. Chewie measures the wavelength of the Hα line as 656.33124nm (rest wavelength is 656.2nm). Estimate the relative *orbital* velocity of Nal Hutta around the galactic centre with respect to Kessel for the navicomputer. **[10]**

   (c) One more thing is needed for the navicomputer. What's the distance from Kessel to Nal Hutta along their line of sight? (*Hint: there are 2 possible solutions.*) **[10]**

   (d) Karabast! An Imperial Star Destroyer showed up. Han wants to wait it out. He thinks they might get bored and move on if they wait long enough. To see if this is a good plan, calculate how long would it take Kessel to rotate around the galactic centre in years? **[4]**

   (e) Hondo's crew have showed up distracting the imperials, leading them away from the system. Han had already shut down power in the Falcon so the navicomputer needs calibrating before they can leave. It needs the mass of the galaxy contained interior to Kessel. Give your answer in terms of M_{Sun}. **[5]**

Question 2 on next page

2. A Cepheid variable star in the Virgo cluster of galaxies is observed to have an apparent magnitude m_v = 24.2. The pulsation period implies that it has an absolute magnitude M_v = -7.2.

(a) If the redshift of the Virgo cluster is z = 0.004, estimate the value of the Hubble constant. **[5]**

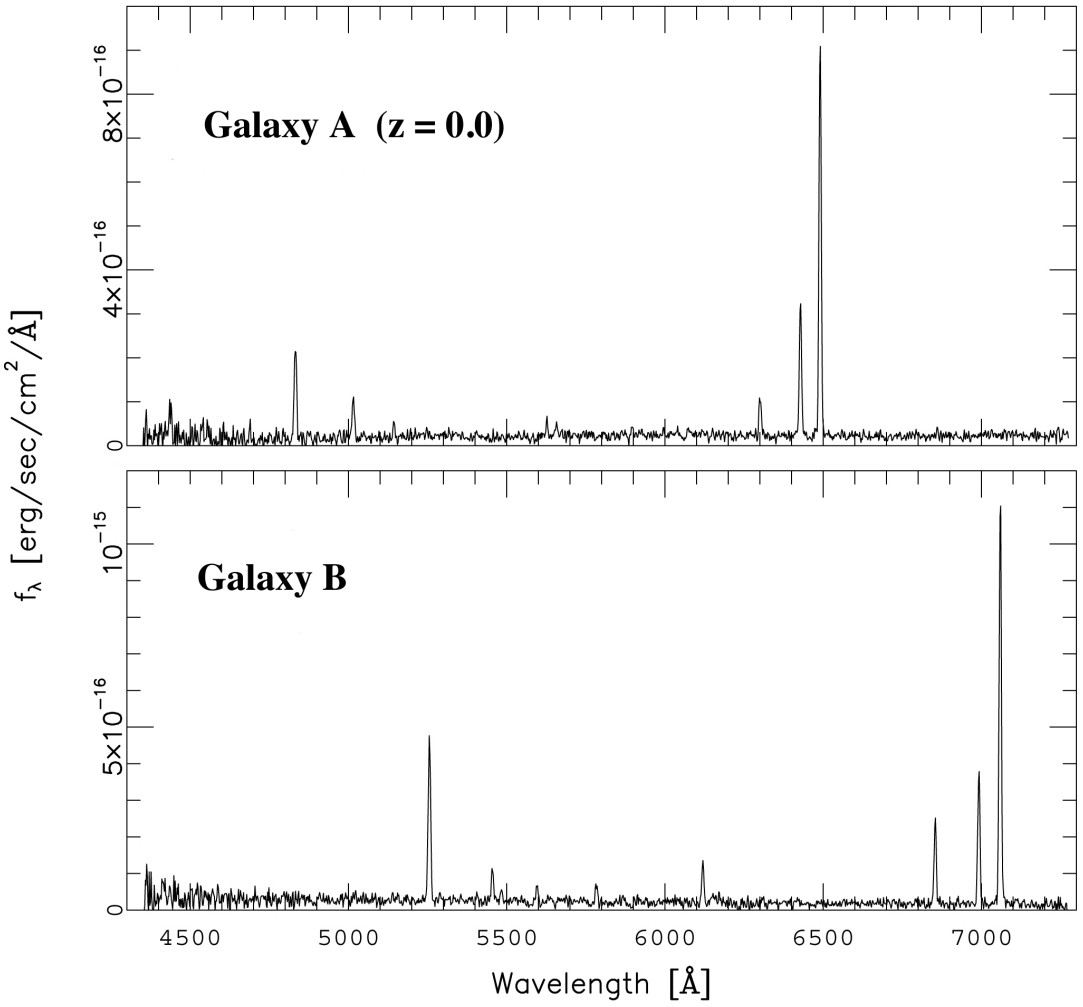
(b) The plot below shows the spectra of two galaxies (A and B) of similar type. If galaxy A has a redshift of z=0.0, estimate the redshift, distance, and radial velocity of Galaxy B. **[4]**

(c) Calculate the wavelength you would expect Hα (rest wavelength 656.2 nm) to be detected in Galaxy B. **[1]**

(d) Calculate how much the Universe expanded since the light from this galaxy was emitted. **[2]**

(e) Calculate the temperature of the Universe when this light was emitted. **[2]**

(f) Images show that Galaxy A is an elliptical galaxy, and galaxy B is a spiral galaxy. Briefly explain which of these galaxies you might expect to observe a type II Supernova. **[2]**



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