Physics of Galaxies 2017/2018

Mock Final Exam June.2018 - Part 1

This first part of the exam will be evaluated on a scale 0-10, and the overall mark will count 25% of the course final grade. For this first part of the exam you cannot use any book or notes. No calculator or other electronic devices are allowed.

1 a) Explain briefly Hubble's classification for late-type galaxies

1 b) Explain the difference between boxy and disky elliptical galaxies.

2 a) What is the initial mass function (IMF)?

2 b) Assume a single stellar population Which stars dominate the stellar mass of a galaxy a few billion years after that single star formation episode?

3 a) What are the two main components in which one can separate a galaxy gravitational potential?

3 b) Describe qualitatively the typical motion of a star in a rotating galaxy

4 a) Enumerate the main components of the Milky Way's structure

4.b) If you compared an optical and a far-infrared map of the Milky Way, what differences would you expect to see? Why?

5 a) Explain briefly the AGN Unification Scheme

5.b) What is the main difference between AGN Types 1 and 2?

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Mock Final Exam June.2018 - Part 2

This second part of the exam will be evaluated on a scale 0-10, and the overall mark will count 35% of the course final grade. For this second part of the exam you are allowed to open all your notes and books. A scientific calculator can be used, but no other electronic devices are allowed.

1 Consider two galaxies with the same apparent K-band magnitude $m_K = 19\,5$ (AB mag), both located at redshift $z = 0\,1$ One of the galaxies is an elliptical, whose K-band light profile is described by a Sérsic law with index $n = 4$, while the other is a disc whose light profile is described with a Sérsic index $n = 1$. Each of the two galaxies subtends an angle of $5''$ diameter on the sky

a) Derive the K-band absolute magnitudes (M_K) of the two galaxies Your final answer should be a number.

b) Obtain the ratio between the two galaxies central surface brightnesses If we conduct a K-band observation reaching a limiting surface magnitude of $\mu_0^{\rm lim} = 25\,{\rm mag\,arcsec^{-2}}$, will these galaxies be detected?

c) Now assume that the elliptical galaxy has a colour $J - K = 1$ (AB mag) In the J band, this galaxy light profile does not strictly follow a de Vaucouleurs' law, but it rather has a Sérsic index $n = 5$. Obtain the central surface brightness in the J band. Your answer should be a number

Max. grade for this problem: 3 points

2 The star formation rate (SFR) Ψ measures the number of solar masses worth of stars formed per unit time

a) In the Solar neighbourhood, the SFR has been roughly constant $\Psi(t) = A$ Show that, in this case, the V-band luminosity function $\Phi_0(M_V)$ is given by

$\Phi_0(M_V) = \Phi_{MS}(M_V)$, when $t \leq \tau_{MS}(M_V)$

and