

AA 472/672

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01/March/2021

## 1 Assignment I/ Tutorial

1. An electron with random Lorentz factor  $\gamma=10^5$  produces a synchrotron photon of energy 10 keV in a blazar jet, find out the magnetic field present in the jet. If the emitted synchrotron photon goes under an Inverse Compton scattering with the same electron, find out the energy of the Inverse Compton photon? [2 Marks]
2. Light takes 90 min to travel through one end to another end of the event horizon? Find out the Eddington luminosity of the system? [2 Marks]
3. The H- $\alpha$  line in the spectrum of a particular quasar was found to be shifted to 9000Å. Given the best estimated  $H_0$  (Hubble constant), determine the distance to the quasar? [2 Marks]
4. An electron with Lorentz factor of  $\gamma=4\times 10^7$  emits a 20 keV photon through Synchrotron emission in the Crab Nebula; the magnetic field strength in the nebula is of the order the  $10^{-4}$  Gauss. Find out the cooling time scale for this electron and the total emitted power? [2 Marks]
5. A quasar shows the variability of the order of half an hour time scale at the TeV energies in the observer frame. Can a 100 TeV photon be produced inside this emission zone through Photo-Hadronic (P- $\gamma$ ) process? Consider the random magnetic field at the emission site is 1 G, and the Doppler factor of the jet is 10. [2 Marks]