Astronomy 423 Homework Set 9

Due: Monday, Apr. 17

1. A relativistic electron has a Lorentz factor (γ) of 5000, and is spiraling in a magnetic field of 10^{-5} Gauss with a pitch angle of 90 degrees. (a) At what frequency will it produce its peak emission (in GHz)? (b) What is the timescale for it to radiate away its kinetic energy in the form of synchrotron radiation?

2. An active galaxy is observed to have the following electric vector polarization angles: 38.6, 118.7, 97.8, and 58.1 degrees at frequencies of 1385, 1465, 4860 and 8460 MHz respectively. (a) Calculate the Faraday Rotation Measure and the intrinsic magnetic field orientation assuming that the radiation is optically thin. (b) Estimate the magnetic field strength of the Faraday screen assuming a density of 0.1 cm^{-3} and a path length of 1 kpc.

3. The turnover frequency ($\tau = 1$) for a typical HII region at the Galactic center is close to 330 MHz (90 cm). For an electron temperature (T_e) of 8000 K, find the emission measure, EM, of this HII region. You can assume that the Gaunt factor is unity.

4. Observe a Pulsar with the LWA. Make your schedule for April 12. Assignments:

   Megan Lewis, Veronica Dike, Chris Gallagher: B0329+54 session ID 0325
   Peter Sinclair, Josh Johnson, Daniel Puentes: B0834+06 session ID 0326
   Savin Shynu Varghese, Chris DiLullo, Kirtus Leyba: B1133+16 session ID 0327
   Tim Braun, Michael Collopy, Danny Sprinkle: B1919+21 session ID 0328
   Joe Malins, David Munich, Bahram Saba, Chris Quintana: B2217+47 session ID 0329

   You will need to log in to the astr423 account on hercules.phys.unm.edu (password is LWA4fun$) in order to schedule the observations. Use the session definition file:
COMGT_150324_1924_0225_B3.SDF
   as a starting point. Invoke the session editor with:
/usr/local/extensions/SessionSchedules/sessionGUI.py COMGT_150324_1924_0225_B3.SDF

   You will need to change the following fields:
   A) Session ID (under Observer Information)
   B) Target name, UTC start time, RA, DEC

Save the file with a name like: COMGT_170412_HHMM_SSID_B3.SDF where HHMM is the UTC starting time of your file and SSID is assigned above. Then e-mail the file to me and once it has been observed I will let you know where to find it. There is a guide to reducing the observations on the class web site (pulsar_guide.pdf). You will do this from the cluster out at the site which you can log in to from Hercules by ssh –X lwaucf4 with same account and password as you use to get on to Hercules. To avoid confusion do your work in the directory /data/local/astr423/NNN where NNN is your session ID.