Third werkcollege for the Galaxies course

In this assignment you will explore the SDSS database to learn about the colour and spatial distribution of stars in our Galaxy.

- Background and general information about SDSS can be found here http://www.sdss.org and http://cas.sdss.org/dr5/en/. The most recent data release paper is Adelman-McCarthy et al. (2007) which can be retrieved from the above websites (but you don't really need it for this assignment).

- You will need to select stars in two fields: one located at low latitude and one located at high-latitude. The coordinates of these fields in the equatorial system are: $\alpha = 123.8^o$, $\delta = 3^o$ and $\alpha = 171.2^o$, $\delta = 23^o$.

- To access the SDSS database goto http://cas.sdss.org/dr5/en/tools/search/form/form.asp

- Select stars within 1 degree around the above mentioned coordinates. Do not put any constraints on their colour, but consider only those that are brighter than 25 mag in all bands, and fainter than 10 mag.

- You will want to retrieve all stars, but the only information that you really need are their sky coordinates and their magnitudes

- Submit the query and wait to get a table (in CSV format)

Now that you have the data we can start with the exercise.

1. How many stars do you find in each field? Why do you think there is such a difference? Why field lies at higher latitude?

2. Construct the colour-magnitudes of each field diagram using the g and r bands. Because the photometry is not very accurate for faint stars, do not plot stars fainter than $r = 20$ mag. At the bright end there is saturation, and so consider only those stars fainter than $r = 15$.

   (a) What is the colour range in which most stars are found?
   (b) Describe the main features of the CMDs.
   (c) What is the overdensity towards the red end? Why does it become prominent for magnitudes fainter than $g \sim 17$?
   (d) If you plot the same number of stars in the CMDs, what are the main differences that you can see between the high and low latitude fields?

3. Construct a histogram (number of stars as function of their $(g - r)$ colour) for each field. It is preferable to normalize the histograms to the total number of stars present in each field, within the same colour and apparent magnitude ranges previously used.

   (a) In which field is the fraction of A, F, G stars higher? Why? What does this tell us about the spatial distribution of stars in the Galaxy?

   (b) In which of the fields are there relatively more red stars? Why?

   (c) In which field can one find the largest fraction of very blue stars, namely with $(g - r) \sim 0.2$. Why? To which component of the Galaxy do these stars belong?

4. Let us now focus on the high-latitude field. At which colour is the turnoff for the thick disk stars? What about for halo stars? Is it bluer or redder? Why? Why is there a difference in the apparent magnitude of the stars in these populations?