Phys 194–FYRE PS 5

Given: Oct 4, 2017. Due: Oct 11, 2017

Homework Policy: You can consult class notes and books. Always try to solve the problems yourself; if you cannot make progress after some effort, you can discuss with your classmates or ask the instructor. However, you cannot copy other's work: what you turn in must be your own. Make sure you are clear about the process you use to solve the problems: partial credit will be awarded.

Problem 1 P-$\dot{P}$ Diagram

Get P-$\dot{P}$ data for this problem from:
`http://www.gravity.phys.uwm.edu/~kaplan/FYRE/p_pdot_ps5.csv`
or find `p_pdot_ps5.csv` in the shared area at `notebook.nanograv.org`.
  You need to load the data into python. We will do that in a slightly different way:

```
from astropy.table import Table
data=Table.read('p_pdot_ps5.csv',delimiter=';')
P=data['P0']
Pdot=data['P1']
pulsarname=data['NAME']
```

Instead of using `np.loadtxt()`, we are using an astropy Table here since that is more flexible in terms of the data we read in. So we now have 3 arrays, `P`, `Pdot`, and `pulsarname`. The first two are normal arrays of floating point numbers that you can treat as you would expect. The third is an array of *strings*, but you can still look at (for example) `pulsarname[i]` etc.

a. What is the shortest and longest period in this data-set? Which pulsar has the shortest and longest period (remember `np.argsort()`)?

b. What is the highest and lowest $\dot{P}$ in this data-set? Which pulsar has the highest and lowest $\dot{P}$?

c. Compute the magnetic field:

$$B = 3.2 \times 10^{19}\,\mathrm{G}\sqrt{P\dot{P}}$$

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and characteristic age:

$$\tau = \frac{P}{2\dot{P}}$$

What are the highest and lowest B and τ values, and which pulsars are those?

d. Now we want to make a P-$\dot{P}$ diagram from these data. Make sure both axes show the $\log_{10}$, either using `plt.loglog()` or another method. Make sure the axes are labeled.

e. Bonus ideas:

    (a) Label the extreme pulsars you found in the earlier parts with colored circles

    (b) Plot lines of constant B and τ on your diagram. You can use the `plt.contour()` function to do this, although there are other ways.

For this problem please save your plot and send it to `astro-fyre-instruct@uwm.edu`. Also save the code you use for all parts of this problem to a file in your shared area.