Exercises for the CW session

Exercise 1.

1. Each pulsar folder contains 3 .sbl files with the data and the two basic signals in the extracted band + a .m file containing the pulsar description (e.g. pulsar_3s.m).

2. Run the program g=pss_band_recos1 for each sbl file. It corrects for Doppler and spin-down (and down-sample data). It produces a gd containing the corrected data:

```
g=pss_band_recos1(pulsar_3s(),'sim6_p3s.sbl',1024);
g0=pss_band_recos1(pulsar_3s(),'s0_p3s.sbl',1024);
g45=pss_band_recos1(pulsar_3s(),'s45_p3s.sbl',1024);
```

3. Plot the data and compute the power spectrum.
Use Snag to plot the time series and the corresponding power spectrum.
Plot also the two signal components.

4. Choose a threshold for cleaning data
and clean the data: `[gclean deld]=rough_clean(g,-thr,thr,60);`
A plot containing the original time series and the cleaned one is produced. The cleaned time series is stored in the gd gclean.

5. Plot the cleaned data and the corresponding power spectrum. Check if the signal (with amplitude modulation) is now visible.

7. Apply the Wiener filtering:

```
[gw, nois,wien]=ps_wiener(gclean,4.5,3);
```

8. Compute the 5-vectors for both the data and the two signal components:

```
v5dat=compute_5comp(gw,.85715941);
v5sig0=compute_5comp(g0,.85715941,wien);
v5sig45=compute_5comp(g45,.85715941,wien);
```

The second input value is f-round(f), where f is the signal “apparent” frequency, and can be read in the log file produced by pss_band_recos1.

9. Estimate source parameters:

```
[sour stat]=estimate_psour(v5dat,v5sig0,v5sig45);
```

Compare with the injected values.

Exercise 2.
1. Run the same pipeline used in Exercise 4. to search for a real pulsar.
The needed .sbl files are in the folder psr_j1. The data here allow to search for a GW signal from J0024-7204F.

2. Use the estimated h0 value to establish if you can claim a detection

3. Set an UL (say at 95% confidence level) to the amplitude of a GW signal in the data.

For points 2 and 3 you can use the matlab program `filter_dist_mc` located under /CW.

Exercise 3.
Estimate the time T above which the Doppler shift effect becomes relevant (and produces a signal loss if not properly taken into account)
Hint: The time T comes out to be much shorter than a sidereal day, then only the Earth rotation around its axis must be considered.

Exercise 4.
Estimate the time needed to discriminate between a really monochromatic (instrumental) signal and a GW signal emitted by a source located at the ecliptic pole.

Exercise 5 :
Estimate the observation time above which a given spin-down value becomes relevant.

Exercise 6.
Estimate the maximum precision with which the position of a source can be determined (neglecting source intrinsic velocity and uncertainty in the source parameters).

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