

Pulsar RX J0209.6-7427: <https://arxiv.org/pdf/2004.04930.pdf>

1. Unzip thelevel1 data:

```
cd /home/jayashree/Desktop/LT_workshop/Pulsar_RX/data/
```

```
unzip LEVL1AS1LXP20191214T03_168T01_9000003368_22771.zip
```

```
unzip LEVL1AS1LXP20191214T03_168T01_9000003368_22772.zip
```

```
unzip LEVL1AS1LXP20191214T03_168T01_9000003368_22773.zip
```

```
unzip LEVL1AS1LXP20191214T03_168T01_9000003368_22774.zip
```

```
unzip LEVL1AS1LXP20191214T03_168T01_9000003368_22777.zip
```

OUTPUT :

```
jayashree@jayashree:~/Desktop/LT_workshop/Pulsar_RX/data/20191214_T03_168T01_9000003368_level1/
```

```
laxpc$ ls
```

```
22771 22772 22773 22774 22777
```

2. Create Analysis folder:

```
>~/home/jayashree/Desktop/LT_workshop/Pulsar_RX/Analysis$ mkdir Analysis
```

3. In the Analysis folder set the path of laxpc level1 data (Set the variable \$LAXPCDATAPATH to where your data is ending with the laxpc directory)

```
jayashree@jayashree:~/Desktop/LT_workshop/Pulsar_RX/$cd Analysis
```

```
jayashree@jayashree:~/Desktop/LT_workshop/Pulsar_RX/Analysis$export
```

```
LAXPCDATAPATH="/home/jayashree/Desktop/LT_workshop/Pulsar_RX/data/  
20191214_T03_168T01_9000003368_level1/laxpc"
```

4. Initialize heasoft:

```
jayashree@jayashree:~/Desktop/LT_workshop/Pulsar_RX/Analysis$heainit
```

Creating level2 events file and gti

5. Make data files list of level1 data

```
jayashree@jayashree:~/Desktop/LT_workshop/Pulsar_RX/Analysis$ laxpc_make_filelist
```

OUTPUT: eventfiles filterfiles orb_filelist

6. Create level2 fits event file from level1 event files

```
jayashree@jayashree:~/Desktop/LT_workshop/Pulsar_RX/Analysis$ laxpc_make_event eventfiles
```

OUTPUT: level2.event.fits

7. Create good time interval (gti) file by removing removes earth occultation and SAA

```
jayashree@jayashree:~/Desktop/LT_workshop/Pulsar_RX/Analysis$ laxpc_make_stdgti filterfiles
```

OUTPUT:usergti.fits

Barycenter correction of LAXPC event file

5(a) Create merged orbit file from different level1 data sets

```
jayashree@jayashree:~/Desktop/LT_workshop/Pulsar_RX/Analysis$ laxpc_make_merged_orbit orb_filelist
```

OUTPUT: merged_orbits.fits

5(b) The as1bary tool applies a barycenter correction to the level2 event data file

USAGE: /home/jayashree/as1bary/as1bary -i orbitFile -f inputDataFile [-o outFile][-ra RA] [-dec DEC] [-ref refFrame]

```
jayashree@jayashree:~/Desktop/LT_workshop/Pulsar_RX/Analysis$ /home/jayashree/as1bary/as1bary -i  
merged_orbits.fits -f level2.event.fits -o bary_level2.event.fits
```

OUTPUT: bary_level2.event.fits

Creating lightcurve from barycenter corrected level2 fits event file

6. Create lightcurve in 3-30 keV and 3-80 keV energy band.

```
jayashree@jayashree:~/Desktop/LT_workshop/Pulsar_RX/Analysis$ gedit eneinput
```

```
jayashree@jayashree:~/Desktop/LT_workshop/Pulsar_RX/Analysis$more eneinput
```

```
3.0 30.0
```

7. To make lightcurve in 3-30 keV using layer 1 (Top layer) data

USAGE: `laxpc_make_lightcurve [-p (which pcu? all or e.g. 12)] [-t timebin] [-u (user gti ascii file)] [-o output filename] [-e energy define file] [-l Layer no] level2.event.fits`

```
jayashree@jayashree:~/Desktop/LT_workshop/Pulsar_RX/Analysis$ laxpc_make_lightcurve -p 2 -l 1 -t 0.1 -u usergti.fits -e eneinput bary_level2.event.fits
```

OUTPUT: `lightcurve_L1_3.0_30.0keV.lc lightcurve_L1_3.0_80.0keV.lc`

Plotting Lightcurve using task “lcurve”

8. Plotting lightcurve using lcurve

USAGE: `lcurve nser file(s)+options window dtnb nbint outfile plot plotdev`

```
jayashree@jayashree:~/Desktop/LT_workshop/Pulsar_RX/Analysis$ lcurve 1 lightcurve_L1_3.0_30.0keV.lc
```

```
window=default dtnb=1.0 nbint=41265 outfile=default plot=yes plotdev=/xw
```

OUTPUT:lightcurve_L1_3.0_30.0keV.flc

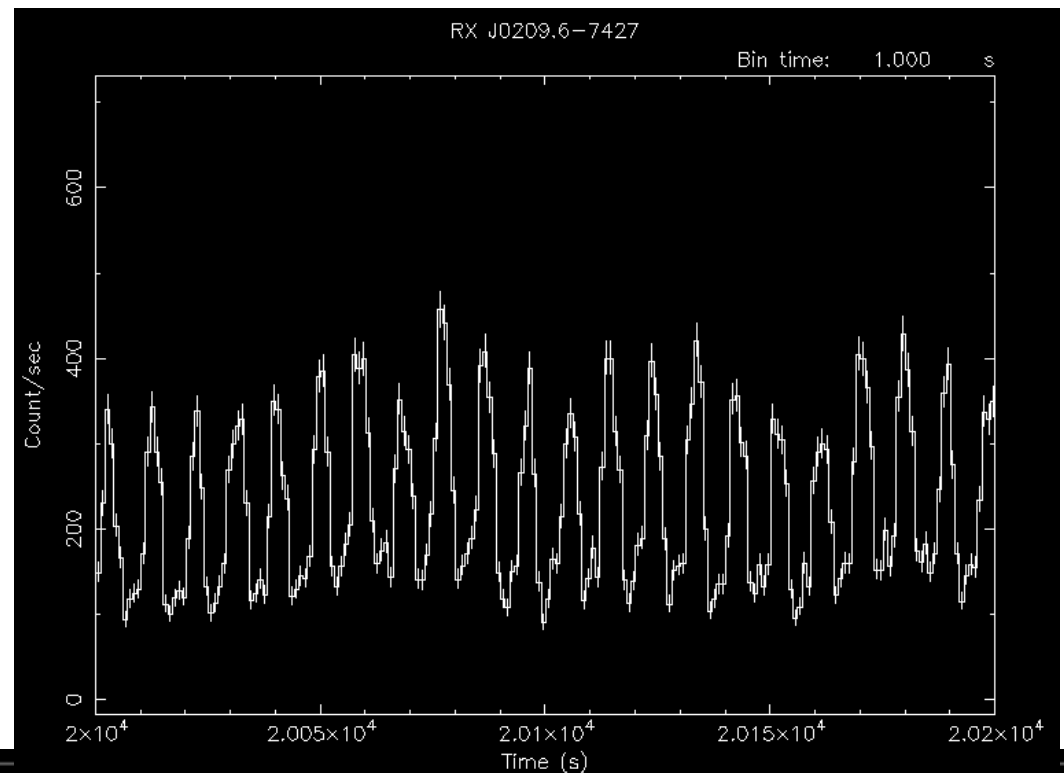
Plotting zoomed in lightcurve using lcurve

```
PLT> r x 20000 20200
```

```
PLT> li st on
```

```
PLT> pl
```

Approximately 9.2 sec oscillations are visible in the lightcurve.



Power Density Spectrum using task “powspec”

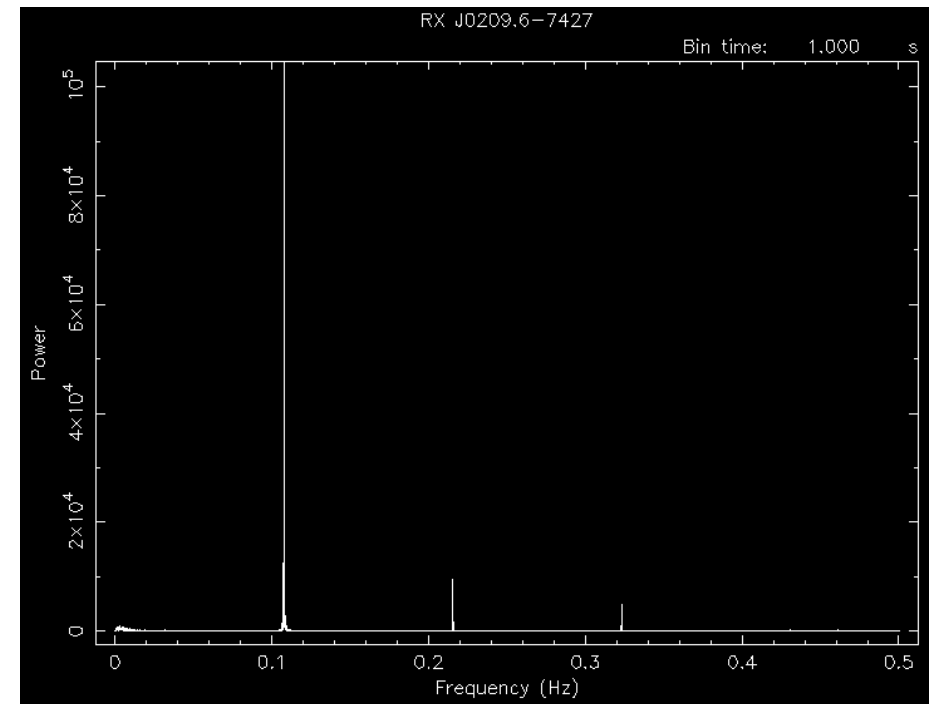
9. USAGE: `powspec file(s)+options window dtnb nbint nintfm rebin outfile plot plotdev`

`jayashree@jayashree:~/Desktop/LT_workshop/Pulsar_RX/Analysis$ powspec lightcurve_L1_3.0_30.0keV.lc`

`window=default dtnb=1.0 nbint=8192 nintfm=6 rebin=0 outfile=yes plot=yes plotdev=/xw`

The plot shows a pulsation peak at 0.107678570 Hz providing an approximate pulsation period of ~ 9.28 sec.

OUTPUT:`lightcurve_L1_3.0_30.0keV.fps`



Best period search using task “efsearch” (to find out accurate period if an approximate period is known)

10. USAGE: `efsearch file(s)+options window sepochn dper nphase nbint dres nper outfile plot plotdev`

`jayashree@jayashree:~/Desktop/LT_workshop/Pulsar_RX/Analysis$ efsearch lightcurve_L1_3.0_30.0keV.lc`

`window=default sepochn=18831.56941539737 dper=9.28 nphase=16 nbint=71147 dres=0.00001 nper=8192`

`outfile=default plot=yes plotdev=/xw`

Shows best period 9.28371 sec.

OUTPUT:`lightcurve_L1_3.0_30.0keV.fes`

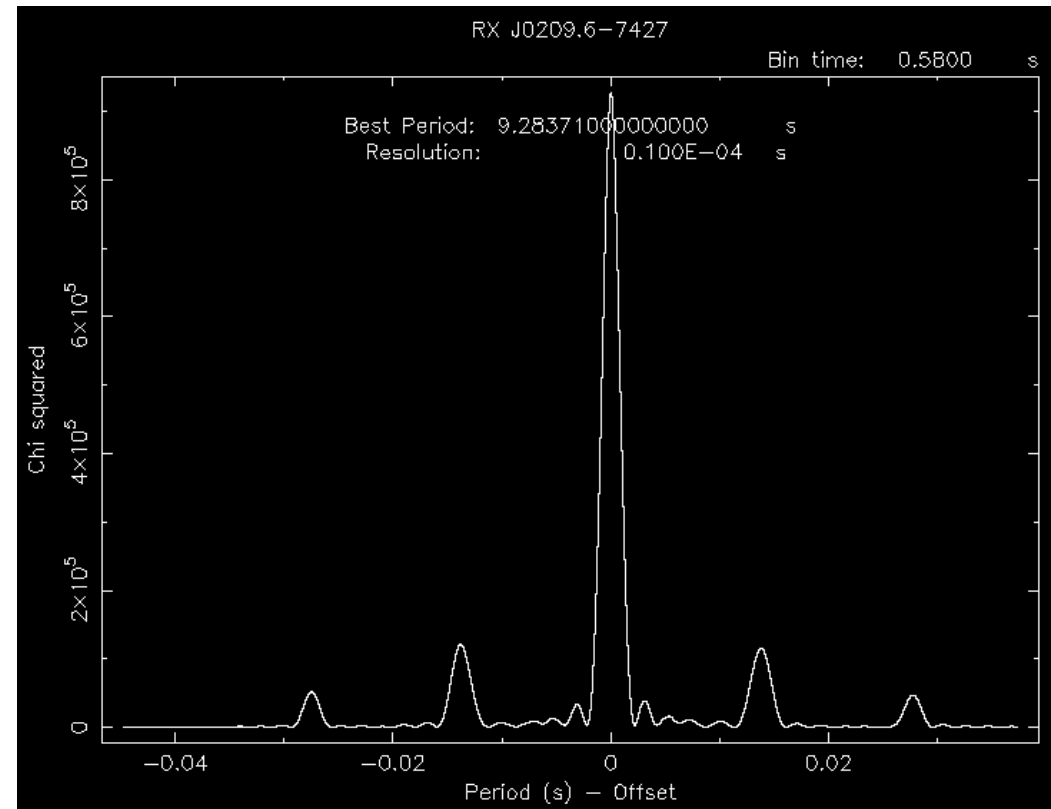
TASK: `>efsearch lightcurve_L1_3.0_30.0keV.lc`

`window=default sepochn=18831.56941539737`

`dper=9.28371 nphase=16 nbint=71119`

`dres=0.00001 nper=8192 outfile=default`

`plot=yes plotdev=/xw`



Create folded lightcurve using task “efold”

USAGE: `efold nser file(s)+options window seepoch dper nphase nbint nintfm plot plotdev plotdnum outfile`

`jayashree@jayashree:~/Desktop/LT_workshop/Pulsar_RX/Analysis$ efold 1 lightcurve_L1_3.0_30.0keV.lc`

`window=default seepoch=18831.56941539737 dper=9.28371 nphase=16 nbint=71119 nintfm=1 plot=yes`

`plotdev=/xw plotdnum outfile=default`

OUTPUT:`lightcurve_L1_3.0_30.0keV.fef`

