Pulsar Astronomy — 2000 and Beyond
ASP Conference Series, Vol. 202, 2000
M. Kramer, N. Wex, and R. Wielebinski, eds.

CLYPOS: the Cananea-Ljubljana Young Pulsar Optical Survey

Alberto Carramiñana[1], Andrej Čadež[2] & César Alvarez[1]

1. Instituto Nacional de Astrofísica Optica y Electrónica (INAOE), Luis Enrique Erro No. 1 Tonantzintla Puebla 72840, México
2. University of Ljubljana, Department of Physics, Ljubljana, Slovenia

Abstract. The Cananea-Ljubljana Young Pulsar Optical Survey, or CLYPOS, is an observational study of $\gtrsim 30$ known radio pulsars, in search for pulsed optical emission. The survey is being carried out at the 2.12m telescope of the Observatorio Astrofísico Guillermo Haro, near Cananea, Sonora, using the stroboscopic camera of the University of Ljubljana. We restricted the study to young pulsars with declination $\delta > -35°$, prioritized in terms of $\dot{E}/d^2$. Our strategy consists in spending two hours of observing time per pulsar, scanning the whole pulsed-phase interval three times. Further details are given below.

1. Sample

The sample includes young isolated pulsars -i.e. we excluded ms and binary pulsars-, observable from Cananea -approximate latitude 31°, and ranked in terms of $\dot{E}/d^2 \propto \dot{P}/(P^3\,d^2)$, where the distance d is normally estimated through the pulsar dispersion measure. Some previously studied pulsars (like Geminga, PSR B1951+32 and PSR B0656+54) were excluded and the Crab was observed only for estimating our upper limits.

2. Strategy

The Ljubljana stroboscopic camera, described in Galicic et al (1999), was adapted to the LFOSC camera in its imaging mode, in which BVRI and white light images can be acquired with a 6×10 arcmin field with ~ 1 arcsec/pixel sampling. The stroboscopic camera served to synchronize the acceptance of light with the pulsar frequency, estimated with means of published ephemerides (ref, including Princeton catalog). The stroboscope duty cycle was set to 25%, using a purpose made chopper wheel -different to the one previously used for Crab studies. The observational setup included a pulse generator coupled to a GPS clock to control the chopper wheel.

Twenty-four consecutive 5 minutes exposures were taken for each pulsar. We deliberately set an offset $\sim 4.0 \times 10^{-4}$ Hz for the chopper frequency relative to the pulsar frequency, such as to have a constant pulse phase displacement $\Delta\varphi \simeq 12.5\%$ from one image to next, with the dead-time (CCD readout; approx 13 seconds per image) taken into account.

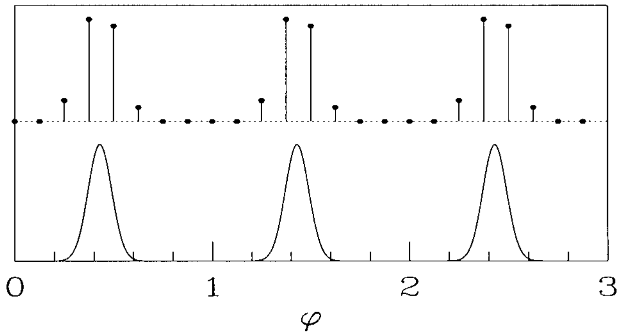

Figure 1. A fictitious single pulse light curve -lower frame- and the measured fluxes -upper frame-, for each of the 24 images. For this particular example, the highest point contains 88% of the flux. If bright enough, the pulsar would show in images 3, 4 , 11, 12, 19 and 20.

We note that most of the ephemerides used were not very recent (we unsuccesfully tried to get newer ones), but because the total observing time is just ~ 2 hours, the required precision is $\varepsilon(\varphi) \sim 10^{-4}$ Hz, i.e. not too demanding. Furthermore, errors comparable to the frequency offset, would result in a different slippage rate. Our observations would be affected only for frequency errors $\gtrsim 10^{-3}$ Hz.

Observations are being carried out without filter, to maximize light input, with a short one minute exposure after each 24 image round, to calibrate our upper limits through field stars. Our data analysis, in process, is targetted at finding the appearance and disappearance of a point source at the position of the radio pulsar (Figure 1). Scanning through three cycles provides a consistency check for the presence of any optical pulsed emission.

Our (V-magnitude) lower limits will be estimated assuming an optical spectrum identical to the one of the Crab pulsar. Preliminary estimates indicate that we can detect pulsations brigther than 23rd magnitude. This in turn requires an efficiency $Lopt/\dot{E}_{rot}$ in the range 10^{-4} to 10^{-3}, much higher than $\sim 0.7 \times 10^{-5}$ measured for the Crab pulsar. We hope to detect any pulsar with unexpected high conversion of energy losses into optical luminosity, or -probably more likely- to provide bounds for a sizeable sample. We expect to conclude observations early in 2000 and present them soon afterwards.

Acknowledgments. We acknowledge the support of Dick Manchester in the use of the TEMPO pulsar analysis software. This work was partially supported by CONACyT grant 25539E.

References

Čadež, A. & Galičič, M., 1996, A&A 306, 443

Galičič, M., 1999, Ph.D. Thesis, University of Ljubljana

https://doi.org/10.1017/S0252921100059777 Published online by Cambridge University Press