The newly discovered X–ray pulsar 4U 1822–37

Peter G. Jonker(*University of Amsterdam*) Michiel van der Klis (*University of Amsterdam*), Paul Groot (*CfA*),

Abstract

We report the discovery of 0.59 s X–ray pulsations from the low–mass X–ray binary, 5.57 hr dipping and eclipsing ADC source 2A 1822–371. Pulse arrival time analysis indicates a circular orbit with e $<$0.03 (95% confidence) and an a$\sin i$ for the neutron star of 1.006(5) lightseconds, implying a mass function of $(2.03 \pm 0.03) \times 10^{-2} M_{\odot}$. The barycentric pulse period was 0.59325(2) s in 1996.270 and 0.59308615(5) s in 1998.205, indicating an average spin up with $\dot{P}/P = (-1.52 \pm 0.02) \times 10^{-4} \mathrm{yr}^{-1}$. For a magnetic field strength of $\sim$1–5$\times 10^{12}$ G as derived from the X–ray spectrum the implied intrinsic X–ray luminosity is $\sim$2–4$\times 10^{37} \mathrm{erg\,s}^{-1}$. The pulse amplitude is low, but increases steeply as a function of energy from a sinusoidal amplitude of 0.25% in 2–5.4 keV to $\sim$3% above 20 keV.

4U 1822–37 is optically bright and has a well–constrained inclination (because it is eclipsing), measuring the radial velocity of the companion star would therefore allow for a full binary solution, providing the first accurate mass of a neutron star in an LMXB. Harlaftis, Charles, & Horne (1997, MNRAS, 285, 673) tried measuring the radial velocity of the companion in 4U 1822–37 using spectra obtained with the 3.9 m AAT using He Iλ5876. The presence of an extra absorption component in the same part of the spectrum and the relatively low resolution ($\sim$75 km/s for $H\alpha$) which kept them from resolving the two components, yielded a lower limit on the radial velocity of the companion star of 225 km/s. This constrains the mass of the neutron star to be $> 0.6^{+1.0}_{-0.3} M_{\odot}$. Here, we report on the discovery of the pulsar and of our recent attempts using the VLT and the 6.5 m Magellan to measure the radial velocity curve.

CATEGORY: BLACK HOLE AND NEUTRON STAR BINARIES