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The transient low-mass X-ray binary IGR J18245-2452 is again active as a radio pulsar

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*on **17 May 2013; 01:20 UT***
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We have recently identified the transient low-mass X-ray binary IGR J18245-2452 in M28 (Atel #4925, #4927, #4929, #4934, #4959, #4960, #4961, #4964, #4981, #5003, #5031, #5045, #5068) as the radio pulsar J1824-2452I (hereafter M28I; see Papitto et al. 2013, arXiv:1305.3884). We have secured this identification through the XMM-Newton detection of X-ray pulsations with the same spin and orbital parameters as known from previous radio timing (see ATNF catalog: http://www.atnf.csiro.au/research/pulsar/psrcat/ and S. Begin 2006, MSc thesis, UBC), as well as from the detection of X-ray pulsations during a type-I X-ray burst detected by Swift/XRT.

On April 29th, 2013 we started a radio monitoring campaign to pin-point the reactivation of the source as a radio pulsar. This campaign has used the Green Bank Telescope (GBT; at 2GHz), Parkes telescope (at 1.4GHz), and Westerbork Synthesis Radio Telescope (WSRT; at 1.4GHz). All telescopes were used in standard pulsar observing modes recording with the GUPPI, AFB/BPSR, and PuMaII backends respectively. Subsequent to the X-ray outburst, the radio pulsar has been detected sporadically by each of these telescopes:

UT Date-time	Telescope	Orb. phase	S/N	Flux (mJy)
2013-04-29-13:26	Parkes	0.57-0.80	-	-
2013-05-02-03:56	WSRT	0.24-0.47	7	0.05 +/- 0.03
2013-05-04-03:53	WSRT	0.59-0.76	-	-
2013-05-06-04:04	WSRT	0.96-0.18	-	-
2013-05-06-07:07	GBT	0.24-0.36	-	-
2013-05-07-02:43	WSRT	0.02-0.35	-	-
2013-05-09-10:37	GBT	0.09-0.21	-	-
2013-05-10-13:03	Parkes	0.48-0.94	12	0.06 +/- 0.03
2013-05-11-09:43	GBT	0.36-0.47	9	0.01 +/- 0.005
2013-05-13-10:22	GBT	0.77-0.89	12	0.02 +/- 0.01
2013-05-13-16:25	Parkes	0.32-0.77	8	0.05 +/- 0.03

Each radio observation was folded using a local, X-ray derived rotational ephemeris and the known dispersion measure. Although the radio detections are all weak, they are roughly consistent with the past known brightness of the radio pulsar (about 0.05mJy at 2GHz) and the S/N clearly peaks at the predicted period and dispersion measure. The flux values are in most

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cases not properly calibrated and hence have large systematic uncertainties. We have marked non-detections with no S/N or Flux value.

Given the known, irregular eclipses in M28I, it is likely that non-detections at orbital phases close to 0.25 (superior conjunction of the pulsar) are due to eclipsing. Thus, we caution that non-detections are not constraining as to whether the radio pulsar was active at that time.

Most importantly these detections clearly show that the source is visible as a radio pulsar only ~5 weeks after the peak in the X-rays (Atel #4929). IGR J18245-2452/M28I conclusively shows that such systems switch back and forth between accreting binary and radio pulsar - on surprisingly short timescales (see Papitto et al. 2013, arXiv:1305.3884 for further details).

We are further investigating the behavior of this system via archival analysis and continued monitoring with the GBT.

Plots of our detections are available here: http://www.astron.nl/~hessels/IGRJ18245-2452/

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