Observing Application

Date :	Dec, 01 2008
Proposal ID :	VLBA/08C-124
Legacy ID :	BD141
PI :	Adam Deller
Type :	Rapid Response - Exploratory Time
Category :	Galactic, Astrometry/Geodesy
Total Time :	8.0

Exploratory observations for a VLBA parallax of the binary MSP J1023+0038

Abstract:

We have discovered a bright nearby eclipsing millisecond pulsar with a non-degenerate companion, a key 'missing link' in binary evolution. Its companion is a 17th magnitude star, and the system appears to have had an accretion disc as recently as 2001, being tentatively classified as a Low Mass X-ray Binary (LMXB) in quiescence. Because both pulsar timing and radial velocity measurements are available, one of the few remaining unknowns is system inclination angle. Using the assumption that the companion fills its Roche lobe, a VLBI parallax and hence distance to the source would yield the inclination angle, and from there an accurate and nearly model-independent pulsar mass and a mass and radius for the peculiar secondary. We request these observations to test the suitability of a candidate in-beam calibrator and to provide initial epochs for a parallax determination. A timely start to observations is crucial, since the potential exists for the system to re-enter an accreting phase, which would presumably quench the radio emission.

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Related proposals:

Joint:

Not a Joint Proposal

Observing type(s):

Pulsar, Phase Referencing

VLBA Resources

Name	Wavelength	Processor	Stations	Observing Parameters	Correlation Parameters
Pulsar phase-	21 cm	Socorro	VLBA ☑ Br ☑Fd ☑Hn ☑Kp ☑ La ☑Mk ☑Kp ☑Ov ☑ Pt ☑Sc ☑ HSA Ar Ef GBT VLA-Y27 VLA-Y1 Geodetic	Bandwidth: 8 MHz Baseband Channels 8 Sample Rate (Msample/s) 16 Bits/Sample 2 Polarization RCP Agg. Bit Rate (Mbits/sec) 256	Full Polarization Pulsar Gate ☑ Correlator Passes 2 Averaging Time (sec) 2.0 Spectral Points /BBC 8

Sources:

Name	RA / RA Range	Dec / Dec Range	Epoch	Velocity / z	Group
PSR J1023+0038	10:23:47.7 00:00:00.0	+00:38:41 00:00:00	J2000	Velocity : 0.00	Pulsar and primary phase reference
J1024-0052	10:24:29.6 00:00:00.0	-00:52:55 00:00:00	J2000	Velocity : 0.00	Pulsar and primary phase reference
PMN J1023+0024	10:23:38.7 00:00:00.0	+00:24:16 00:00:00	J2000	Velocity : 0.00	Pulsar and primary phase reference

Sessions:

Name	Session Time (hours)	Repeat	Separation	GST minimum	GST maximum	Elevation Minimum
Parallax observations	4.00	2	60 day	00:00:00	00:00:00	0

Session Constraints:

Name	Constraints	Comments
Parallax observations		Should ideally be scheduled to maximise elevation at all antennas over the observation duration

Session Source/Resource Pairs:

Session Name	Source	Resource	Time	Figure of Merit
Parallax observations	PSR J1023+0038 J1024-0052 PMN J1023+0024	Pulsar phase-referencing	4.0 hour	0.09 mJy/bm

Staff support: None Plan of Dissertation: no