Observing Application

Date :	Feb, 29 2012
Proposal ID :	VLBA/12A-455
Legacy ID :	BM371
PI :	Matthew Middleton
Type :	Director's Discretionary Time - Target of Opportunity
Category :	Energetic Transients and Pulsars
Total Time :	12.0

Resolving the nature of the only ULX jet detected in the radio band

Abstract:

The recent discovery of a new ultraluminous X-ray source (ULX) in M31 has allowed for the first genuine opportunity to detect the presence of radio emission that may be associated with a jet, an expected feature should the unknown compact object be an intermediate mass black hole (IMBH). Our recent EVLA ToO has provided the first highly significant evidence for this. The emission does not appear to be nebular in origin as seen for other ULXs with the inverted radio spectrum suggesting that we are observing a persistent, optically thick jet from a sub-Eddington accreting IMBH. Importantly however the X-ray spectrum appears inconsistent with this identification. A 12 hour ToO with VLBA will determine whether the emission is compact and unresolved, from a resolved jet, or (though unlikely) from a diffuse nebular region. From this ToO we will be able to resolve the issues surrounding the inconsistent X-ray spectrum and obtain a more complete understanding of the emission and nature of the compact object. As the lifetime of the outburst is unknown, we request that a DDT observation be performed in the very near future to avoid the likelihood of the source decaying into quiescence.

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Related proposals:

Joint:

Not a Joint Proposal

Observing type(s):

Continuum, Single Pointing(s)

VLBA Resources

Name	Details	Stations	Observing Parameters	Correlation Parameters
VLBA-X	**Wavelength:** 3.6 cm **Processor:** Socorro-DiFX **Observing** Standard	VLBA ☑ Br ☑ Fd ☑ Hn ☑ Kp ☑ La ☑ Mk ☑ Nl ☑ Ov ☑ Pt ☑ Sc ☑ HSA Ar Ef GBT VLA-Y27 VLA-Y1 Geodetic	Bandwidth: 16 MHz Baseband Channels 8 Sample Rate (Msample/s) 32 Bits/Sample 2 Polarization Dual Agg. Bit Rate (Mbits/sec) 512	Full Polarization ☑ Pulsar Gate Correlator Passes 1 Integration Period (sec) 2.0 Spectral Points /BBC 16 No of Fields 1

Sources:

Name	Position		Velocity		Group
XMMU J004243.6+412519	**Coordinate System**	Equatorial	**Convention**	Radio	M31 ULX
	Equinox	J2000			
	Right Ascension	00:42:43.6	**Ref. Frame**	LSRK	
		00:00:00.0			
	Declination	+41:25:19.0	**Velocity**	0.00	
		00:00:00.0			

Sessions:

Name	Session Time (hours)	Repeat	Separation	GST minimum	GST maximum	Elevation Minimum
ULX detection	12.00	1	0 day	01:30:00	14:00:00	0

Session Constraints:

Name	Constraints	Comments
ULX detection		Full VLBA track for maximum sensitivity.

Session Source/Resource Pairs:

Session Name	Source	Resource	Time	Figure of Merit
ULX detection	XMMU J004243.6+412519	VLBA-X	12.0 hour	0.03 mJy/bm

Staff support: None Plan of Dissertation: no