Observing Application

Date :	Oct, 06 2012
Proposal ID :	VLBA/12B-390
Legacy ID :	BR175
PI :	Joseph Richards
Type :	Director's Discretionary Time - Target of Opportunity
Category :	Active Galactic Nuclei
Total Time :	60.0

Follow-up of exceptional radio and GeV/TeV gamma-ray flares in blazar Mrk 421

Abstract:

We propose a series of Target of Opportunity VLBA total intensity and polarization observations of the high-synchrotron-peaked (HSP) BL Lac object Mrk 421 (z=0.031) in response to a radio flare of a magnitude and speed unprecedented in this object, and unexpected based on the current models for HSP blazars. This flare was first reported by us as a rapid increase of roughly 600 mJy at 15 GHz, and represents the first major radio flare in Mrk 421 in at least 30 years. Multifrequency single dish observations have shown a similar increase in all observed frequencies from 2.6 to 143 GHz. This follows less than two months behind the peak of a major GeV and TeV gamma-ray flare. This unique event presents a rare opportunity to investigate a major radio flare in an HSP blazar. We expect to identify the location of the flaring emission, characterize the flare energetics, and determine whether superluminal motions consistent with the high Doppler factors implied by TeV flares are present during this event. The rapid rise of this flare suggests a similarly rapid decline is likely, so immediate observation is essential.

Authors:

Name	Institution	Email	Status
Joseph Richards	Purdue University	jlr@purdue.edu	
Talvikki Hovatta	California Institute of Technology	thovatta@caltech.edu	
Tuomas Savolainen	Max-Planck-Institut für Radioastronomie	tsavolainen@mpifr-bonn.mpg.de	
Matthew Lister	Purdue University	mlister@purdue.edu	
Anthony Readhead	California Institute of Technology	acr@astro.caltech.edu	
Margo Aller	Michigan at Ann Arbor, University of	mfa@umich.edu	
Hugh Aller	Michigan at Ann Arbor, University of	haller@umich.edu	
Lars Fuhrmann	Max-Planck-Institut für Radioastronomie	lfuhrmann@mpifr-bonn.mpg.de	
Emmanouil Angelakis		angelaki@mpifr-bonn.mpg.de	
Marcello Giroletti	Istituto di Radioastronomia	giroletti@ira.inaf.it	

Principal Investigator: Joseph Richards
Contact: Joseph Richards
Telephone: 626-321-3253
Email: jlr@purdue.edu

Related proposals:

Joint:

Not a Joint Proposal

Observing type(s):

Continuum, Polarimetry

VLBA Resources

Name	Details		Stations	Observing Parameters		Correlation Parameters	
VLBA-3mm	**Wavelength:** 3 mm **Processor:** Socorro-DiFX **Observing Mode:** Standard		VLBA ☑ Br ☑ Fd ☑ Hn ☑ Kp ☑ La ☑ Mk ☑ Nl ☑ Ov ☑ Pt ☑ Sc ☑ HSA ☐ Ar ☐ Ef ☐ GBT ☐ VLA-Y27 ☐ VLA-Y1 ☐ Geodetic	Observing System: Bandwidth: Baseband Channels Sample Rate (Msample/s) Bits/Sample Polarization Agg. Bit Rate (Mbits/sec)	PFB System 32 MHz 16 64 2 Dual 2048	Full Polarization ☑ Pulsar Gate ☐ Convert to Mark4 ☐ Correlator Passes 1 Integration Period (sec) 2.0 Spectral Points /BBC 64 No of Fields 1	
VLBA-7mm	**Wavelength:** 7 mm **Processor:** Socorro-DiFX **Observing Mode:** Standard		VLBA ☑ Br ☑ Fd ☑ Hn ☑ Kp ☑ La ☑ Mk ☑ Nl ☑ Ov ☑ Pt ☑ Sc ☑ HSA ☐ Ar ☐ Ef ☐ GBT ☐ VLA-Y27 ☐ VLA-Y1 ☐ Geodetic	Observing System: Bandwidth: Baseband Channels Sample Rate (Msample/s) Bits/Sample Polarization Agg. Bit Rate (Mbits/sec)	PFB System 32 MHz 16 64 2 Dual 2048	Full Polarization ☑ Pulsar Gate ☐ Convert to Mark4 ☐ Correlator Passes 1 Integration Period (sec) 2.0 Spectral Points /BBC 64 No of Fields 1	
VLBA-1.3cm	**Wavelength:** 1.3 cm **Processor:** Socorro-DiFX **Observing Mode:** Standard		VLBA ☑ Br ☑ Fd ☑ Hn ☑ Kp ☑ La ☑ Mk ☑ Nl ☑ Ov ☑ Pt ☑ Sc ☑ HSA ☐ Ar ☐ Ef ☐ GBT ☐ VLA-Y27 ☐ VLA-Y1 ☐ Geodetic	Observing System: Bandwidth: Baseband Channels Sample Rate (Msample/s) Bits/Sample Polarization Agg. Bit Rate (Mbits/sec)	PFB System 32 MHz 16 64 2 Dual 2048	Full Polarization ☑ Pulsar Gate ☐ Convert to Mark4 ☐ Correlator Passes 1 Integration Period (sec) 2.0 Spectral Points /BBC 64 No of Fields 1	
VLBA-2cm	**Wavelength:** 2 cm **Processor:** Socorro-DiFX **Observing Mode:** Standard		VLBA ☑ Br ☑ Fd ☑ Hn ☑ Kp ☑ La ☑ Mk ☑ Nl ☑ Ov ☑ Pt ☑ Sc ☑ HSA ☐ Ar ☐ Ef ☐ GBT ☐ VLA-Y27 ☐ VLA-Y1 ☐ Geodetic	Observing System: Bandwidth: Baseband Channels Sample Rate (Msample/s) Bits/Sample Polarization Agg. Bit Rate (Mbits/sec)	PFB System 32 MHz 16 64 2 Dual 2048	Full Polarization ☑ Pulsar Gate ☐ Convert to Mark4 ☐ Correlator Passes 1 Integration Period (sec) 2.0 Spectral Points /BBC 64 No of Fields 1	