The Blazar Times

A Research Newsletter Dedicated to the BL Lac and Blazar Phenomena

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Employment Opportunities

NRC Postdoctoral Research Award at the Jet Propulsion Laboratory

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The Astronomical Measurements Group at the Jet Propulsion Laboratory (JPL), California Institute of Technology, is inviting applicants to apply for a National Research Council (NRC) Research Associate position at JPL. The Research Associate will participate in basic astronomical research, either observational or theoretical. Our group has ongoing programs in observational radio astronomy, numerical general relativity, end-to-end astrophysical mission simulation, and numerical studies of accretion disks and jet formation in galactic microquasars and in active galactic nuclei. We are also involved in the design of large arrays of radio antennas for the future Deep Space Network. We seek candidates who are interested in contributing to one or more of these areas. Applicants should have a Ph.D. in astronomy by the starting date and strong written and verbal communications skills. The successful applicant will have access to good research facilities and support at JPL including considerable computing resources and access (through competitive proposals) to antennas of the Deep Space Network and the Palomar 5-m Hale Telescope. The appointment is for one year, renewable for an additional year. Annual starting salary for a recent Ph.D. is approximately $45,000 and can vary somewhat depending on the applicant's qualifications. Separate funds for travel are also available.

To apply, refer to the NRC web page at http://www.national-academies.org/rap for instructions, forms, and deadlines. Note that the next deadline for applications is 1 May 2003. Before applying, please contact Dr. Dayton Jones at 818-354-7774, dj@sgra.jpl.nasa.gov or at the address listed above to discuss your research interests.

Journal Abstracts

The HRX-BL Lac sample - evolution of BL Lac objects

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The unification of X-ray and radio selected BL Lacs has been an outstanding problem in the blazar research in the past years. Recent investigations have shown that the gap between the two classes can be filled with intermediate objects and that apparently all differences can be explained by mutual shifts of the peak frequencies of the synchrotron and inverse Compton component of the emission. We study the consequences of this scheme using a new sample of X-ray selected BL Lac objects comprising 104 objects with $z < 0.9$ and a mean redshift $\bar{z} = 0.34$. 77 BL Lacs, of which the redshift could be determined for 64 (83%) objects, form a complete sample. The new data could not confirm our earlier result, drawn from a subsample, that the negative evolution vanishes below a synchrotron peak frequency $\log \nu_{\rm peak} = 16.5$. The complete sample shows negative evolution at the 2σ level ($\langle V_{\rm e}/V_{\rm a}\rangle = 0.42 \pm 0.04$). We conclude that the observed properties of the HRX BL Lac sample show typical behaviour for X-ray selected BL Lacs. They support an evolutionary model, in which flat-spectrum radio quasars (FSRQ) with high energetic jets evolve towards low frequency peaked (mostly radio-selected) BL Lac objects and later on to high frequency peaked (mostly X-ray selected) BL Lacs.

Accepted by A&A

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For preprints via WWW: http://arXiv.org/abs/astro-ph/0302242

VLBI Polarimetry of 177 Sources from the Caltech-Jodrell Bank Flat-spectrum Survey

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We present VLBA observations and a statistical analysis of 5 GHz VLBI polarimetry data from 177 sources in the Caltech-Jodrell Bank flat-spectrum (CJF) survey. The CJF survey, a complete, flux-density-limited sample of 293 extragalactic radio sources, gives us the unique opportunity to compare a broad range of source properties for quasars, galaxies and BL Lacertae objects. We focus primarily on jet properties, specifically the correlation between the jet axis angle and the polarization angle in the core and jet. A strong correlation is found for the electric vector polarization angle in the cores of quasars to be perpendicular to the jet axis. Contrary to previous claims, no correlation is found between the jet polarization angle and the jet axis in either quasars or BL Lac objects. With this large, homogeneous sample we are also able to investigate cosmological issues and AGN evolution.

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For preprints via ftp or WWW: http://www.aoc.nrao.edu/ gtaylor/cjfpolar/cjfpolar.ps.Z

Temporal Variability of Mrk 421 from XMM−Newton Observations

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We present the results of a detailed spectral and temporal analysis of the currently available XMM-Newton observations of the bright BL Lac object Mrk 421 using mainly the EPIC-PN data. The source was found in various intensity states differing by up to a factor of five in count rates. In general, the source is more variable and shows a harder spectrum during higher intensities than when it is in lower states. The spectrum is very complex and cannot be fitted adequately by a broken power law or a continuously curved model. We find that the flux variations on time scales of $\gtrsim$ few thousand seconds are associated with significant and sometimes very complex spectral changes. The spectral variability rate is not the same in all cases and is correlated with the source flux state: the spectral variations per unit

time increase with the source flux. The Cross-Correlation analysis shows that the soft and hard band light curves are often well correlated near zero lag, in other cases the hard band variations lead the soft band variations by typically ~ 5 min, in two cases we find the soft band leading the hard band variations. The delays appear to be correlated to the flares' duration: the shorter the flare, the smaller the delay.

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The Radio Structure of High-Energy Peaked BL Lacertae Objects

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We present VLA and first-epoch VLBA observations that are part of a program to study the parsec-scale radio structure of a sample of fifteen high-energy-peaked BL Lacs (HBLs). The sample was chosen to span the range of logarithmic X-ray to radio flux ratios observed in HBLs. As this is only the first epoch of observations, proper motions of jet components are not yet available; thus we consider only the structure and alignment of the parsec- and kiloparsec-scale jets. Like most low-energy-peaked BL Lacs (LBLs), our HBL sample shows parsec-scale, core-jet morphologies and compact, complex kiloparsec-scale morphologies. Some objects also show evidence for bending of the jet 10–20pc from the core, suggesting interaction of the jet with the surrounding medium. Whereas LBLs show a wide distribution of parsec- to kpc-scale jet misalignment angles, there is weak evidence that the jets in HBLs are more well-aligned, suggesting that HBL jets are either intrinsically straighter or are seen further off-axis than LBL jets.

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High-Resolution Radio Imaging of Gravitational Lensing Candidates in the 1 Jansky BL Lac Sample

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While BL Lacertae objects are widely believed to be highly beamed, low-luminosity radio galaxies, many radio-selected BL Lacs have extended radio power levels and optical emission lines that are too luminous to be low-luminosity radio galaxies. Also, Stocke & Rector discovered an excess of MgII absorption systems along BL Lac sightlines compared to quasars, suggesting that gravitational lensing may be another means of creating the BL Lac phenomenon in some cases. We present a search for gravitationally-lensed BL Lacs with deep, high-resolution, two-frequency VLA radio maps of seven lensing candidates from the 1 Jansky BL Lac sample. We find that none of these objects are resolved into an Einstein ring like B 0218+357, nor do any show multiple images of the core. All of the lensing candidates that were resolved show a flat-spectrum core and very unusual, steep-spectrum extended morphology that is incompatible with a multiply lensed system. Thus, while these observations do not rule out microlensing, no macrolensing is observed.

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Optical and Radio Behaviour of the BL Lacertae Object 0716+714

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Eight optical and four radio observatories have been intensively monitoring the BL Lac object 0716+714 in the last years: 4854 data points have been collected in the $UBVRI$ bands since 1994, while radio light curves extend back to 1978. Many of these data, which all together constitute the widest optical and radio database available on this object, are presented here for the first time. Four major optical outbursts were observed at the beginning of 1995, in late 1997, at the end of 2000, and in fall 2001. In particular, an exceptional brightening of 2.3 mag in 9 days was detected in the R band just before the BeppoSAX pointing of October 30, 2000. A big radio outburst lasted from early 1998 to the end of 1999. The long-term trend shown by the optical light curves seems to vary with a characteristic time scale of about 3.3 years, while a longer period of 5.5–6 years seems to characterize the radio long-term variations. In general, optical colour indices are only weakly correlated with brightness; a clear spectral steepening trend was observed during at least one long-lasting dimming phase. Moreover, the optical spectrum became steeper after JD $\sim$ 2451000, the change occurring in the decaying phase of the late-1997 outburst. The radio flux behaviour at different frequencies is similar, but the flux variation amplitude decreases with increasing wavelength. The radio spectral index varies with brightness (harder when brighter), but the radio fluxes seem to be the sum of two different-spectrum contributions: a steady base level and a harder-spectrum variable component. Once the base level is removed, the radio variations appear as essentially achromatic, similarly to the optical behaviour. Flux variations at the higher radio frequencies lead the lower-frequency ones with week–month time scales. The behaviour of the optical and radio light curves is quite different, the broad radio outbursts not corresponding in time to the faster optical ones and the cross-correlation analysis indicating only weak correlation with long time lags. However, minor radio flux enhancements simultaneous with the major optical flares can be recognized, which may imply that the mechanism producing the strong flux increases in the optical band also marginally affects the radio one. On the contrary, the process responsible for the big radio outbursts does not seem to affect the optical emission.

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Abstract Guidelines

Abstracts for "The Blazar Times" are solicited for papers that have been recently accepted for publication by a refereed journal, and for recent Ph.D. theses. Please do not submit an abstract before it has been accepted, nor after it is published. Abstracts from papers which are not refereed (e.g., conference proceedings) are not accepted.

The subject matter should pertain directly to the BL Lac and/or blazar phenomenon in general. Both observational and theoretical abstracts are appropriate. Abstracts from papers dealing with other classes of AGN will generally not be included unless they explicitly discuss their relevance to the blazar phenomenon; however exceptions to this rule will be considered.

A monthly call for abstracts will be issued and abstracts received by the last day of the month will usually appear in the following month's newsletter. Announcements of general interest to the BL Lac and blazar communities may also be submitted for posting in the newsletter. These might include (but are not restricted to) the following: (i) *Job Openings* directed toward blazar researchers, (ii) announcements of *Upcoming Meetings*, (iii) announcements of *Upcoming Observing Campaigns* for which participation is solicited from the community at large, (iv) reviews of *New Books*, and (v) *General Announcements* that provide or request research-related information.

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