

The Blazar Times

A Research Newsletter Dedicated to the BL Lac and Blazar Phenomena

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Journal Abstracts

The Cross-Wavelet Transform and Analysis of Quasiperiodic Behavior in the Pearson-Readhead VLBI Survey Sources

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We introduce an algorithm for applying a cross-wavelet transform to analysis of quasiperiodic variations in a time-series, and introduce significance tests for the technique. We apply a continuous wavelet transform and the cross-wavelet algorithm to the Pearson-Readhead VLBI survey sources using data obtained from the University of Michigan 26-m paraboloid at observing frequencies of 14.5, 8.0, and 4.8 GHz. Thirty of the sixty-two sources were chosen to have sufficient data for analysis, having at least 100 data points for a given time-series. Of these thirty sources, a little more than half exhibited evidence for quasiperiodic behavior in at least one observing frequency, with a mean characteristic period of 2.4 yr and standard deviation of 1.3 yr. We find that out of the thirty sources, there were about four time scales for every ten time series, and about half of those sources showing quasiperiodic behavior repeated the behavior in at least one other observing frequency.

Accepted by ApJ

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For preprints via WWW: <http://www.astro.lsa.umich.edu/obs/radiotel/prcwdata.html>

Spectral Slope Variability of BL Lac Objects in the Optical Band

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Light curves of eight BL Lac objects in the BVRI bands have been analyzed. All of the objects tend to be bluer when brighter. However spectral slope changes differ quantitatively from those of a sample of QSOs analyzed in a previous paper and appear consistent with a different nature of the optical continuum. A simple model representing the variability of a synchrotron component can explain the spectral changes. Constraints on a possible thermal accretion disk component contributing to the optical luminosity are discussed.

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For preprints via ftp or WWW: <http://arxiv.org/abs/astro-ph/0212524>

A Systematic Study Of X-Ray Variability In The ROSAT All-Sky Survey

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We present a systematic search for variability among the ROSAT All-Sky Survey (RASS) X-ray sources. We generated lightcurves for about 30 000 X-ray point sources detected sufficiently high above background. For our variability study different search algorithms were developed in order to recognize flares, periods and trends, respectively. The variable X-ray sources were optically identified with counterparts in the SIMBAD, the USNO-A2.0 and NED data bases, but a significant part of the X-ray sources remains without cataloged optical counterparts. Out of the 1207 sources classified as variable 767 (63.5 %) were identified with stars, 118 (9.8 %) are of extragalactic origin, 10 (0.8 %) are identified with other sources and 312 (25.8 %) could not uniquely be identified with entries in optical catalogs. We give a statistical analysis of the variable X-ray population and present some outstanding examples of X-ray variability detected in the ROSAT all-sky survey. Most prominent among these sources are white dwarfs, apparently single, yet nevertheless showing periodic variability. Many flares from hitherto unrecognised flare stars have been detected as well as long term variability in the BL Lac 1E 1757.7+7034.

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Modelling the TeV γ -ray Spectra of Two Low Redshift AGNs: Mkn 501 & Mkn 421

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We discuss the results of modelling the TeV γ -ray spectra of two AGNs, Mkn 501 and Mkn 421 that have almost the same redshifts: $z = 0.031$ and $z = 0.034$, respectively. The effect of intergalactic γ -ray absorption is treated as an uncertainty in the measurement of the intrinsic spectrum. Although the objects differ, we obtain satisfactory fits for both of them in a synchrotron self-Compton scenario. Compared to previous models, our fits are characterised by higher values of the Doppler factor ($\delta \geq 50$) and an electron injection spectrum extending to higher energies ($\gamma_{\max} \geq 1.5 \times 10^5$). In the case of Mkn 421, the observed difference in spectral slope in X-rays and TeV γ -rays between the high and low states can be explained as a variation of a single parameter — the maximum energy $\gamma_{\max} mc^2$ at which electrons are injected.

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Does Circular Polarisation Reveal the Rotation of Quasar Engines?

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Many radio sources like quasars, blazars, radio galaxies, and micro-quasars exhibit circular polarisation (CP) with surprising temporal persistent handedness. As a possible explanation we propose that the CP is due to Faraday conversion (FC) of linear polarisation (LP) synchrotron light which propagates along a line-of-sight through twisted magnetic fields. The rotational nature of accretion flows onto black holes naturally generates the required magnetic twist in the emission region, independent of whether it is a jet or an ADAF. The expected twist in both types of flows

is of the order of what is required for optimal CP generation. This scenario requires that Faraday rotation (FR) is insignificant in the emission region. Although this is an assumption, it relaxes constraints on the plasma parameters, that were given in scenarios which rely on FR, since there the strength of FR can not be too far from the optimum. The proposed mechanism works in electron-positron (e^\pm) as well as electron-proton (e/p) plasma. In the latter case, the emission region should consist of individual flux tubes with independent polarities in order to suppress too strong FR. The predominant CP is expected to mostly counter-rotate (rotation is measured here in sky-projection) with respect to the central engine in all cases (jet or ADAF, e^\pm or e/p plasma). If the proposed mechanism is indeed operating, it will allow to measure the sense of rotation of quasar engines. The engine of SgrA* is then expected to rotate clockwise and therefore counter-Galactic, as do the young hot stars in its vicinity, which are thought to feed SgrA* by their winds. Generally, sources with Stokes- $V < 0$ ($V > 0$) are expected to rotate clockwise (counter-clockwise) in this scenario.

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Relativistic Parsec-scale Jets: II. Synchrotron Emission

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We calculate the optically thin synchrotron emission of fast electrons and positrons in a spiral stationary magnetic field and a radial electric field of a rotating relativistic strongly magnetized force-free jet consisting of electron-positron pair plasma. The magnetic field has a helical structure with a uniform axial component and a toroidal component that is maximal inside the jet and decreasing to zero towards the boundary of the jet. Doppler boosting and swing of the polarization angle of synchrotron emission due to the relativistic motion of the emitting volume are calculated. The distribution of the plasma velocity in the jet is consistent with the electromagnetic field structure. Two spatial distributions of fast particles are considered: uniform, and concentrated in the vicinity of the Alfvén resonance surface. The latter distribution corresponds to the regular acceleration by an electromagnetic wave in the vicinity of its Alfvén resonance surface inside the jet. The polarization properties of the radiation have been obtained and compared with the existing VLBI polarization measurements of parsec-scale jets in BL Lac sources and quasars. Our results give a natural explanation of the observed bimodality in the alignment between the electric field vector of the polarized radiation and the projection of the jet axis on the plane of the sky. We interpret the motion of bright knots as a phase velocity of standing spiral eigenmodes of electromagnetic perturbations in a cylindrical jet. The degree of polarization and the velocity of the observed proper motion of bright knots depend upon the angular rotational velocity of the jet. The observed polarizations and velocities of knots indicate that the magnetic field lines are bent in the direction opposite to the direction of the jet rotation.

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For preprints via ftp or WWW: <http://www.arxiv.org/abs/astro-ph/0303361>

A Search for Intraday Variability in the Blazar PKS 2005–489

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Rapid, multi-color optical monitoring carried out for a multiwavelength campaign during 22-27 August 2000 is presented for the bright and variable BL Lac object PKS 2005–489. Previous multiwavelength monitoring campaigns of PKS 2005–489 have found complex variability behavior both in flux density and in broadband spectrum, with

different modes and timescales from days to hours. During this campaign, PKS 2005–489 was observed to be in an unusual state, bright in the optical but faint in the X-ray, just prior to an X-ray flare that began on 2 September 2000. PKS 2005–489 was also observed to have a flatter optical spectrum than prior epochs. A linear increase in optical flux density was observed during the first 5.2 days of the campaign. However, intraday and color variability were not detected. The large discrepancy between the ratio of X-ray to optical flux density observed during this campaign and that observed in prior epochs indicates a lack of long-term correlation between the two wavebands; and it illustrates that simple particle injection events in the jet are insufficient to explain the long-term variability behavior of this object. Twenty-three in-field standard stars are identified for future optical monitoring programs.

Accepted by AJ

For preprints via ftp or WWW: <http://xxx.lanl.gov/abs/astro-ph/0304059>

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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