

The Blazar Times

A Research Newsletter Dedicated to the BL Lac and Blazar Phenomena

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Thesis Abstracts

Radio Variability and Interstellar Scintillation of Blazars

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Ph.D dissertation directed by: Dr. Roger Clay (U. Adelaide), Dr. Tasso Tzioumis (ATNF)

Ph.D degree awarded: August 2003

This thesis presents several observational studies based on radio variability and interstellar scintillation of extragalactic flat-spectrum radio sources. Such sources are commonly called “blazars”, a term used to describe the phenomenon observed when the jet of a radio-loud Active Galactic Nucleus (AGN) is directed towards the observer. These sources provide unique “laboratories” for studying the physics of relativistic jets.

Observations of selected samples of blazars, made with the Australia Telescope Compact Array (ATCA) and the Australia Telescope Long Baseline Array are presented here. Statistics for long-term (months–years) and short-term (intraday) variability in both total and linearly polarized flux density at several frequencies are presented. The sensitivity and flux density measurement accuracy of the ATCA make it particularly useful for observations of intraday variability (IDV). Resolving the question of what is the mechanism for radio IDV was of great importance at the time this thesis was being undertaken, since if intrinsic, IDV implies extremely high brightness temperatures, far in excess of the Inverse Compton limit for incoherent synchrotron radiation. Most source models are fundamentally based on the assumption that the radiation from radio to optical, and sometimes soft X-ray, energies is produced by the incoherent synchrotron mechanism, so any result which challenges this has serious implications.

There is now strong evidence that interstellar scintillation (ISS) is the principal cause of radio IDV, which substantially lowers the implied source brightness temperatures from those calculated assuming intrinsic variability. Some of the results presented in this thesis have made an important contribution to the “paradigm shift” from IDV to ISS, by showing unequivocally that the rapid IDV observed in PKS 1257–326 is a result of scintillation due to a nearby

scattering “screen” in the ionised interstellar medium (ISM) of our Galaxy. This unusual source, serendipitously discovered during the course of my PhD, has also proved extremely valuable in showing that ISS can be used as a probe of microarcsecond-scale source structure and also of the local Galactic ISM. Such high angular resolution is not currently achievable even with space interferometer baselines.

Thesis-related Publications: ApJ, 585, 653

Journal Abstracts

Parsec Scale Properties of Markarian 501

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We present the results of a high angular resolution study of the BL Lac object Markarian 501 in the radio band. We consider data taken at 14 different epochs, ranging between 1.6 GHz and 22 GHz in frequency, and including new Space VLBI observations obtained on 2001 March 5 and 6 at 1.6 and 5 GHz. We study the kinematics of the parsec-scale jet and estimate its bulk velocity and orientation with respect to the line of sight. Limb brightened structure in the jet is clearly visible in our data and we discuss its possible origin in terms of velocity gradients in the jet. Quasi-simultaneous multi-wavelength observations allow us to map the spectral index distribution and to compare it to the jet morphology. Finally, we estimate the physical parameters of the parsec-scale jet.

Accepted by ApJ

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For preprints via WWW: <http://www.ira.cnr.it/~mgirolet/pub/mkn501.ps.gz>

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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<http://hosting.uaa.alaska.edu/aftar/blazar/>

Abstracts which are not in this template format cannot be accepted. Both templates are stand-alone LaTeX documents; and I ask that you compile them with LaTeX to check for any errors before submitting. This will save me tremendous efforts in solving any problems; and will assure that your abstract will appear in the newsletter as you had intended. Important: If you use any specially defined characters be sure to include their definitions as well.