The Blazar Times

A Research Newsletter Dedicated to the BL Lac and Blazar Phenomena

No. 59 — November 2003 Editor: Travis A. Rector (blazar@uaa.alaska.edu)

TABLE OF CONTENTS

Job Announcement

Three Postdoctoral Positions and One Ph.D Position

ENIGMA Network[1],Osservatorio Astronomico di Torino[2], Perugia University Observatory[3], and Cork Institute of Technology[4]

[1]ENIGMA Network: Structure and Radiation Processes of AGN through multi-frequency analysis
[2]Osservatorio Astronomico di Torino, Via Osservatorio, Torino, Italy
[3]Perugia University Observatory, Via Bonfigli, 06126, Perugia, Italy
[4]Cork Institute of Technology, Dept. of Applied Physics & Instrumentation, Rossa Avenue, Bishoptown, Cork, Ireland

Within the European Research Training Network ENIGMA on "Structure and Radiation Processes of AGN through multi-frequency analysis" we seek to fill three postdoctoral positions and one Ph.D position. They will be hosted by three of the ten European research institutions working within this project.
The network has been established to carry out research in the following areas:

- Numerical simulations and analytical modeling of Blazar jets to study:
  particle acceleration and radiation mechanisms,
  magneto-hydrodynamic flows,
  jet physics in Blazars.
- Multi-frequency observations of radio-loud AGN to study:
  radio/optical Intra-Day variability,
  relationships between structural and flux density variability,
  relations in different high-energy bands (X-ray, γ-rays, and VHE radiation with Cerenkov telescopes).
- Advanced statistical methods for time-series and applications to astrophysical models.
- Developing high-precision photometric routines in different waveband regimes.
- Developing reliable robotic systems for automated ground-based monitoring of AGN.

The postdocs and Ph.D students will work in their host team and within this active and interacting network of empirical and theoretical research. They are encouraged to spend part of their time at other institutes during their appointment. They will have access to unique observational facilities and will profit from a strong training programme involving hardware-related aspects, observational strategies in all waveband regimes, and theoretical research.

Questions regarding the research programme can be directed to the network coordinator, Stefan Wagner.

The four positions will become available from January 2004. The positions are available for two up to three years. Competitive salaries will be paid, differing according to local regulations. Additional support will be available for extended visits to other partner institutions within the network, network meetings and conferences.

According to the rules of the EC, the positions are open to young researchers, holding a passport of a member or associate state of the European Union. Further details are given by the regulations of the EC programme (http://www.cordis.lu/improving/networks/faq.htm# q5).

Applications should include a curriculum vitae, a publication list, a summary of current research interests as well as a list of topics of interest or institutes which they would prefer to join. Two letters of reference should also be arranged for. The review of applications will srart in December 2003, and will continue until all positions are filled. Material should be sent to Landessternwarte Heidelberg, S. Wagner, Königstuhl 12,69117 Heidelberg, Germany, swagner@lsw.uni-heidelberg.de.

For further information contact: swagner@lsw.uni-heidelberg.de

For further information on WWW: http://www.lsw.uni-heidelberg.de/˜swagner/enigma.html

Journal Abstracts

The Parsec-Scale Structure and Jet Motions of the TeV Blazars 1ES 1959+650, PKS 2155−304, and 1ES 2344+514

B. Glenn Piner[1,2] **and Philip G. Edwards**[3]

[1] Dept. of Physics and Astronomy, Whittier College, 13406 E. Philadelphia St., Whittier, CA 90608 USA
[2] NASA Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Dr., Pasadena, CA 91109 USA
[3] ISAS, Yoshinodai, Sagamihara, Kanagawa 229-8510, Japan

As part of our study of the VLBI properties of TeV blazar jets, we present here a series of high-resolution 15 GHz Very Long Baseline Array (VLBA) images of the parsec-scale jets of the TeV blazars 1ES 1959+650, PKS 2155−304, and 1ES 2344+514, with linear resolutions of ~ 0.5 pc. Each of these sources was observed with the VLBA at three or four epochs during 1999 and 2000. There is a notable lack of any strong moving components on the VLBI images (in contrast to the rapid superluminal motions seen in EGRET blazars), and the structure of the VLBI jet can be modeled either as a series of stationary Gaussian components, or as a smooth power law for two of the sources (PKS 2155−304 and 1ES 2344+514). The low apparent speeds, together with beaming indicators such as the brightness temperature of the VLBI core, imply only modest Doppler boosting of the VLBI radio emission, and only modest bulk Lorentz factors (δ and $\Gamma \approx$ a few); in contrast to the more extreme values of these parameters invoked to explain the high-energy emission. The fact that no moving shocks or plasmoids are seen on the parsec-scale suggests that the shocks or plasmoids that are assumed to be responsible for the high-energy flares must dissipate before they separate from the core on the VLBI images. This requires the loss of a substantial amount of bulk kinetic energy on parsec scales, and implies a higher efficiency than is typically assumed for internal shock scenarios.

Accepted by ApJ

For preprints contact: gpiner@whittier.edu

Extragalactic Sources of TeV Gamma Rays: A Summary

D. Horan[1] **and T. C. Weekes**[1]

[1] Whipple Observatory, Harvard-Smithsonian Center for Astrophysics P.O. Box 97, Amado, AZ 85645-0097 USA

The development of techniques whereby gamma rays of energy 100 GeV and above can be studied from the ground, using indirect, but sensitive, techniques has opened up a new area of high energy photon astronomy. The most exciting result that has come from these is the detection of highly variable fluxes of TeV gamma rays from the relativistic jets in nearby AGN. The recent detection of signals from a starburst galaxy and from a radio galaxy opens the possibility

that the extragalactic emission of TeV gamma rays is a ubiquitous phenomenon. Here we attempt to summarize the properties of the sources detected so far.

Accepted by New Astronomy Reviews

For preprints contact: dhoran@cfa.harvard.edu

For preprints via ftp or WWW: http://lanl.arxiv.org/abs/astro-ph/0310391

TeV Blazars - Observations and Models

Henric Krawczynski

Washington University in St. Louis, Physics Dept., 1 Brookings Drive, CB 1105, St. Louis, MO, 63130

Since the first TeV blazar Markarian (Mrk) 421 was detected in 1992, the number of established TeV gamma-ray emitting BL Lac objects has grown to 6, with redshifts ranging from 0.031 (Mrk 421) to 0.129 (H 1426+428). The intensive study of these sources has had a major impact on our understanding of the blazar phenomenon. The most notable observational results have been extremely fast large amplitude flux and spectral variability on hour time scales, and a pronounced X-ray - TeV gamma-ray flux correlation. In this paper we discuss recent observational results and report on progress in their theoretical interpretation.

Accepted by New Astronomy Reviews

For preprints contact: krawcz@wuphys.wustl.edu

For preprints via WWW: http://xxx.lanl.gov/abs/astro-ph/0309443

Multiwavelength Observations of Strong Flares From the TeV-Blazar 1ES 1959+650

[1] **H. Krawczynski,** [1] **S. B. Hughes,** [2] **D. Horan,** [3] **F. Aharonian,** [4] **M. F. Aller,** [4] **H. Aller,** [5] **P. Boltwood,** [1] **J. Buckley,** [6] **P. Coppi,** [7] **G. Fossati,** [8] **N. Götting,** [9] **J. Holder,** [3] **D. Horns,** [10,11] **O. M. Kurtanidze,** [12] **A. P. Marscher,** [10] **M. Nikolashvili,** [13] **R. A. Remillard,** [14] **A. Sadun,** [2] **M. Schröder**

[1]Washington University in St. Louis, Physics Department, 1 Brookings Drive CB 1105,St. Louis, MO 63130
[2]F. Lawrence Whipple Observatory, Harvard-Smithsonian CfA, Amado, AZ 85645
[3]Max Planck Institut für Kernphysik, Postfach 103980, D-69029 Heidelberg, Germany
[4]University of Michigan, Department of Astronomy, Ann Arbor, MI, 48109-1090
[5]1655 Main Street, Stittsville, Ontario, Canada K2S 1N6
[6]Yale University, P.O. Box 208101, New Haven, CT 06520-8101, USA
[7]Rice University, MS 108, 6100 Main street, Houston, TX 77005
[8]Universität Hamburg, Institut für Experimentalphysik, Luruper Chaussee 149, D-22761 Hamburg, Germany
[9]University of Leeds, Department of Physics, Leeds, LS2 9JT, Yorkshire, UK
[10]Abastumani Astrophysical Observatory, 383762, Abastumani, Republic of Georgia
[11]Landessternwarte Heidelberg-Königstuhl and Astrophysikalisches Institut Postdam
[12]Institute for Astrophysical Research, Boston University, 725 Commonwealth Avenue, Boston, MA 02215-1401
[13]Center for Space Research, Massachusetts Institute of Technology, Cambridge, MA 02139
[14]Department of Physics, University of Colorado at Denver, Denver, CO 80217

Following the detection of strong TeV γ-ray flares from the BL Lac object 1ES 1959+650 with the Whipple 10 m Cherenkov telescope on May 16 and 17, 2002, we performed intensive Target of Opportunity (ToO) radio, optical, X-ray and TeV γ-ray observations from May 18, 2002 to August 14, 2002. Observations with the X-ray telescope *RXTE (Rossi X-ray Timing Explorer)* and the Whipple and HEGRA *(High Energy Gamma Ray Astronomy)* γ-ray telescopes revealed several strong flares, enabling us to sensitively test the X-ray/γ-ray flux correlation properties. Although the X-ray and γ-ray fluxes seemed to be correlated in general, we found an "orphan" γ-ray flare that was not accompanied by an X-ray flare. While we detected optical flux variability with the Boltwood and Abastumani observatories, the data did not give evidence for a correlation between the optical flux variability with the observed X-ray and γ-ray flares. Within statistical errors of about 0.03 Jy at 14.5 GHz and 0.05 Jy at 4.8 GHz, the radio fluxes measured with the University of Michigan Radio Astrophysical Observatory (UMRAO) stayed constant throughout

the campaign; the mean values agreed well with the values measured on May 7 and June 7, 2002 at 4.9 GHz and 15 GHz with the Very Large Array (VLA), and, at 4.8 GHz with archival flux measurements. After describing in detail the radio, optical, X-ray and γ-ray light curves and Spectral Energy Distributions (SEDs) we present initial modeling of the SED with a simple Synchrotron Self-Compton (SSC) model. With the addition of another TeV blazar with good broadband data, we consider the set of all TeV blazars to begin to look for a connection of the jet properties to the properties of the central accreting black hole thought to drive the jet. Remarkably, the temporal and spectral X-ray and γ-ray emission characteristics of TeV blazars are very similar, even though the masses estimates of their central black holes differ by up to one order of magnitude.

Accepted by the ApJ

For preprints contact: krawcz@wuphys.wustl.edu

For preprints via WWW: http://xxx.lanl.gov/abs/astro-ph/0310158

Stacking Searches for > 100 MeV Gamma Ray Emission from Radio and Seyfert Galaxies

A. N. Cillis[1,2], R. C. Hartman[1] and D. L. Bertsch[1,3]

[1] Code 661, NASA's Goddard Space Flight Center, Greenbelt, MD 20771
[2] NRC Resident Research Associate
[3] USRA

The EGRET telescope on CGRO detected more than sixty sources of high-energy gamma radiation associated with active galactic nuclei (AGN). All but one of those belong to the blazar subclass; the only exception is the nearby radio galaxy Centaurus A. Since there is no obvious reason other than proximity to expect Cen A to be the only non-blazar AGN emitting in high-energy gamma rays, we have utilized the "stacking" technique to search for > 100 MeV emission from two non-blazar AGN subclasses, radio galaxies and Seyfert galaxies. Maps of gamma-ray counts, exposure, and diffuse background have been created, then co-added in varying numbers based on sorts by redshift, 5 GHz flux density, and optical brightness, and finally tested for gamma-ray emission. No detection significance greater than 2σ has been found for any subclass, sorting parameter, or number of objects co-added. Monte Carlo simulations have also been performed, to validate the technique and estimate the significance of the results.

Accepted by ApJ for publication in January, 2004

For preprints via anonymous ftp: gamma.gsfc.nasa.gov/pub/stacking/stacking.ps

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.

To subscribe, please send your name and email address to:

`blazar@uaa.alaska.edu`

Contributions and all other correspondence relevant to the newsletter should also be sent to the above address. Please note that I respect the privacy of subscribers; therefore I will not distribute *under any circumstance* the subscriber email list.

To contribute, please use the appropriate LaTeX abstract and thesis templates, which can be obtained from "The Blazar Times" web page at:

`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.