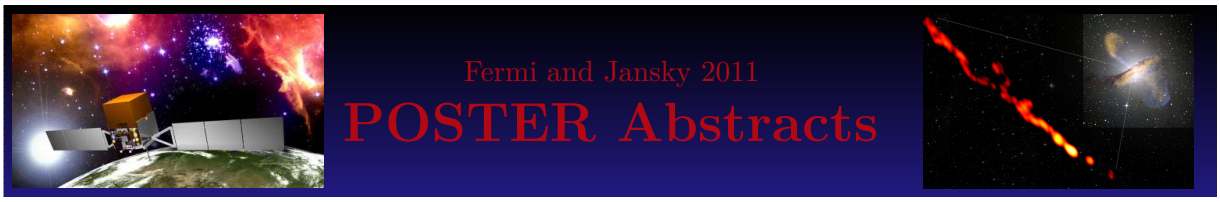

Multi-wavelength Observations of PKS 2142-75 during an Active Gamma-Ray State

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PKS 2142-758 is a flat spectrum radio quasar at a redshift of 1.139 (Jauncey et al., 1978 ApJ, 219, L1) which has been detected in an active state by Fermi/LAT twice since its first flare detection on April 4th, 2010, when it reached a flux of $(1.1 \pm 0.3) \times 10^{-6}\,\mathrm{ph\,cm^{-2}\,s^{-1}}$. This flux represented more than an order of magnitude increase over its quiescent flux. Since the initial flare, this source has been found with daily TS > 25 by Fermi/LAT in a period ranging from October to November of 2010 and another period ranging from July to August of 2011. During the latest flaring period a multi wavelength campaign was carried out using the Ceduna radio telescope, the TANAMI VLBI Array, Swift, and REM. We present results from these observations and discuss their implications for understanding the flaring behavior of AGN.

Fermi's Mystery Sources - Methods for classification and association

Elizabeth Ferrara (GSFC) for the Fermi/LAT Collaboration

The gamma-ray sky as seen by the Fermi-LAT after 2 years of observations contains almost 1900 sources. Yet nearly a third of these sources show no clear association with an object belonging to a known gamma-ray emitting class. To investigate the nature of these sources, a number of multi-wavelength investigations have been initiated to observe the most promising sources in TeV, X-ray, optical, and radio wavebands. In addition, archival searches and correlations with other, less-likely source catalogs provide additional insights into possibilities for the origin of these sources. We discuss the gamma-ray properties of these mystery sources, the methods being used to investigate them, and summarize the results to date of these various initiatives.

Radio loud AGN unification: jet power, orientation, and accretion mode

Markos Georganopoulos (UMBC, NASA/GSFC), Eileen Meyer (Rice University), Giovanni Fossat (Rice University), Matt Lister (Purdue University)

Motivated by recent work (Meyer et al. 2011), we examine the consequences of the following hypothesis: the observed properties of extragalactic jets are a function of the jet kinetic power, accretion mode (efficiently or inefficiently radiating accretion disk), and jet orientation. Following Ghisellini et al. (2009), we adopt the theoretical prediction (Narayan et al. 1997) that the transition from radiatively inefficient to efficient accretion takes place at a fraction $\sim 0.001 - 0.01$ of the Eddington mass accretion rate. We also assume, based on previous work, that contrary to powerful blazars, X-ray peaking blazars exhibit velocity gradients in the plasma responsible for the blazar emission. We show that the implications of this scheme are compatible with trends we find in the M11 sources, and with the picture emerging from Fermi observations.

Multiwavelength Spectral Studies Of Fermi-LAT Blazar

Manasvita Joshi , A. Marscher, S. Jorstad (Boston U.), I. Agudo (Boston U. & IAA), V. Larionov (St. Petersburg State U.), M. Aller (U. Michigan), M. Gurwell (SAO), A. Lahteenmaki (Metsahovi Radio Obs.), Paul Smith (Steward Observatory, University of Arizona)

We present the most up-to-date gamma-ray, x-ray, and optical (both photometric and polarimetric in the R band) lightcurves of Fermi-LAT blazar, 3C279, which is part of the Boston University multiwaveband polarization monitoring program. The data have been compiled from observations with Fermi, Swift, RXTE, the VLBA, and various ground-based optical and radio telescopes starting in August 2008. We simulate the dynamic spectral energy distributions (SEDs) of 3C279, in quiescent and flaring states, within the framework of a multi-slice, time-dependent leptonic jet model for blazars, with radiation feedback, in the internal shock scenario. We use the physical jet parameters obtained from the VLBA monitoring to guide our modeling efforts. We discuss the role of intrinsic parameters and the interplay between synchrotron and inverse Compton radiation processes responsible for producing the resultant SEDs.

This research was supported in part by NASA through Fermi grants NNX10AO59G, NNX08AV65G, and NNX08AV61G, NASA through Swift grants NNX09AR11G, NNX10AL13G, and NNX10AF88G, and by NSF grant AST-0907893.

APEX sub-mm monitoring of gamma-ray blazars

Stefan Larsson (Stockholm University, Sweden), L. Fuhrmann, A. Weiss, E. Angelakis, T.P. Krichbaum, N. Marchili, I. Nestoras, J.A. Zensus (MPIfR, Bonn, Germany), M. Axelsson, D. Nilsson, F. Ryde (KTH, Stockholm, Sweden), L. Hjalmarsdotter (Sternberg Observatory, Moscow, Russia), A. Lundgren (ESO, Chile)

A sample of about 40 gamma-ray blazars have been monitored at sub-mm wavelengths over a time period of 3 to 4 years. Observations were made with the LABOCA detector on the ESO/MPI/Swedish APEX telescope in Chile. The observations have been used to study the sub-mm variability properties and how these relate to source types and gamma-ray characteristics as seen by Fermi LAT.

VLBA monitoring of Mrk 421 at 15 and 22 GHz during 2011

Rocco Lico (Univ. of Bologna & INAF/IRA), M. Giroletti, M. Orienti, G. Giovannini (INAF/IRA), B. Cotton (NRAO), P. Edwards (ATNF), L. Fuhrmann, T. Krichbaum, K. Sokolovsky (MPIfR), S. Jorstad, A. Marscher (Boston Univ.), M. Kino (NAOJ), Y. Kovalev (Lebedev), D. Paneque (Stanford), M.A. Perez-Torres (IAA), G. Piner (Whittier)

We present a preliminary analysis of new high resolution radio observations of the nearby TeV blazar Markarian 421 (z=0.031). We consider data obtained with the Very Long Baseline Array (VLBA) at 6 epochs (one observation per month from January through June 2011) at 15 and 22 GHz. We investigate the inner jet structure, on parsec scale, trough the study of model-fit components for each epoch. Almost all components seem to be stationary. In particular, from fits at 22 GHz we find indications of a limb brightened structure, that will be further discussed from future analysis of data at 43 GHz. This study is part of a most ambitious multifrequency campaign, with observations in sub-mm (SMA), in optical/IR (GASP), in UV/X-ray (Swift, RXTE, MAXI), and in γ-ray (Fermi-LAT, MAGIC, VERITAS). The aim is to try to shine a light definitively on questions such as the nature of radiating particles, the connection between radio and γ-ray emission, the location of emitting regions and the origin of the flux variability.

The Bologna Complete Sample of nearby radio sources: radio and gamma-ray data

Liuzzo Elisabetta , G. Giovannini, M. Giroletti (Istituto di Radioastronomia, INAF, Bologna, Italy)

To study a statistical properties of different classes of radio sources, we defined and observed the Bologna Complete Sample (BCS). The BCS is a complete sample of 95 objects that is unbiased with respect to the orientation of the nuclear relativistic jet being selected from low-frequency samples. Moreover, it is composed by nearby (z<0.1) radio galaxies that are well studied targets with litera-

ture kiloparsec data. For all of them, we collected parsec scale information asking also new VLBI observations. Statistical results on their properties in radio band are presented. From the estimates of the doppler factor and wiewing angles, we discuss the connection with the available gamma-ray data. Finally, we show how future observations with Fermi could reveal new important detections of some of the BCS sources.

$LSI\ +61°303$: A precessing microblazar

M. Massi (MPIfR), E. Ros(University of Valencia/MPIfR), L. Zimmermann (MPIfR)

Changes in the radio morphology of the Be/X-ray binary system $LSI\ +61°303$ suggested in the past the hypothesis of a precessing microquasar. However, in 2006, phase-referenced images from VLBA observations performed all around the orbit, have been taken as evidence for the alternative pulsar model. Recently though, a radio spectral index data analysis has fully confirmed the predictions of the two-peak microquasar model, which therefore does apply in $LSI\ +61°303$. We now reanalysed the VLBA data set improving the dynamic range of the images by a factor of four, using self-calibration. The higher dynamic range of the self-calibrated maps reveals that the radio emission has in six out of ten images a double-sided structure. The pulsar model explains neither the double-sided morphology nor the change from double-sided to a one-sided structure. The microquasar model can explain them with variable Doppler boosting, i.e., with a precessing jet. Moreover, the astrometry, tracing an ellipse, indicates the path traced by the core of the precessing steady jet.

Infrared Colors of the Gamma-ray Detected Blazars

Francesco Massaro & G. Tosti, R. D'Abrsuco (Harvard - Smithsonian Astrophysical Observatory), F. Massaro (Stanford University), M. Ajello (SLAC National Laboratory and Kavli Institute for Particle Astrophysics and Cosmology), J.E. Grindlay (Harvard - Smithsonian Astrophysical Observatory), H. A. Smith (Harvard - Smithsonian Astrophysical Observatory), G. Tosti (Dipartimento di Fisica, Universita' degli Studi di Perugia)

Blazars constitute the most interesting and enigmatic class of extragalactic gamma-ray sources dominated by non-thermal emission. We present how the WISE infrared data make possible to identify a distinct region of the [3.4]-[4.6]-[12] micron color-color diagram where the sources dominated by the thermal radiation are separated from those dominated by non-thermal emission, in particular the blazar population. We show the relation between the infrared and gamma-ray emission for a selected sample of ROMA-BZCAT blazars associated with Fermi sources, for which WISE archival observations are available. The selected blazars lie on the WISE blazar Strip, covering a tighter region of the infrared color-color plots than the overall blazar population. We then search for a correlation between the IR and gamma-ray spectral indices expected in the SSC and EC frameworks. Finally, we estimate the ratio between their gamma-ray and infrared fluxes, a surrogate of the ratio of powers between the inverse Compton and the synchrotron SED components, a parameter that is useful to test these different emitting scenarios.

High resolution radio observations of gamma-ray emitting Narrow Line Seyfert 1s

Monica Orienti (INAF-IRA Bologna), F. D'Ammando (INAF-IRA Bologna), M. Giroletti (INAF-IRA Bologna)

The detection by Fermi-LAT of gamma-ray emission from radio-loud Narrow-Line Seyfert 1s indicates that relativistic jets do not form only in blazars and radio galaxies. Despite a spectral energy distribution similar to blazars, their physical characteristics are quite different: lower black hole masses, generally higher accretion rates, and likely hosted in spirals. Furthermore, their radio properties make the interpretation of these objects even more puzzling. The radio emission is very compact, not exceeding the parsec scales, and it is not significantly variable, as also found in the population of young radio sources. In this talk I will present high resolution VLBA observations of the three radio-loud NLSy1s SBS 0846+513, PKS 1502+036, and PKS 2004-447 detected by Fermi-LAT. The information on the pc-scale morphology will be complemented with studies of flux density and spectral variability from

multi-epoch and multifrequency observations, in order to unveil the nature of their radio emission.

Apparent parsec-scale jet opening angles and gamma-ray brightness of blazars

Alexander Pushkarev (Pulkovo Observatory; Crimean Astrophysical Observatory), M.L. Lister (Purdue University), Y.Y. Kovalev (Astro Space Center of Lebedev Physical Institute; Max-Planck-Institut für Radioastronomie), T. Savolainen (Max-Planck-Institut für Radioastronomie)

We have investigated the differences in apparent opening angles between the parsec-scale jets of the AGN detected by the Fermi Large Area Telescope during its first 24 months of operations and those of non-LAT-detected AGN. We used 15.4 GHz VLBA observations of 215 sources from the 2 cm VLBA MOJAVE program. The apparent opening angles were determined by analyzing transverse jet profiles from the data in the image plane by using stacking images consturcted from all vailable MOJAVE epochs for a given source. We confirm our earlier result based on the first three months of scientific operations of the LAT. The apparent opening angles of gamma-ray bright blazars are preferentially larger than those of gamma-ray weak sources, suggesting smaller viewing angles. Additionally, intrincsic opening angles are derived and discussed.

Lower limits on ultrahigh-energy cosmic ray and jet powers of TeV blazars

Soebur Razzaque (Naval Research Laboratory, Washington DC), Charles D. Dermer & Justin D. Finke (NRL)

Lower limits on the power emitted in ultrahigh-energy cosmic ray (UHECR) protons are derived for TeV blazars with the assumption that the observed TeV gamma rays are generated due to interactions of these protons with cosmic microwave photons. This mechanism may be at work in four blazars, namely 1ES 0229+200; 1ES 1101-232; 1ES 0347-121 and 1ES 1426+428, which are at sufficiently high redshift (>0.1) that allow efficient cascade development to make TeV emission and which are non-varying or very weakly varying at >TeV energies. The lower limits on the UHECR power are lower than the respective synchrotron luminosities in case of all blazars except for 1ES 1426+428. The proposed Auger North Observatory can detect 40 EeV cosmic rays from this extraordinary source and test the UHECR-generated TeV emission model, which requires the intergalactic magnetic field strength to be below 10^{-16}G. The lower limits on the jet power for all four TeV blazars exceed the Eddington luminosity of a 10^9 solar mass black hole in case the injected UHECR spectrum is softer than $E^{-2.2}$.

ATCA Monitoring of gamma-ray loud AGN

Jamie Stevens (CSIRO), Phil G. Edwards (CSIRO), Roopesh Ojha (NASA/GSFC), Matthias Kadler (Univ. Würzburg), Faith Hungwe (Rhodes Univ./HartRAO), Michael Dutka (Catholic Univ.)

We present selected data from four years of periodic monitoring of 130 sources detected by the EGRET and Fermi-LAT telescopes using the Australia Telescope Compact Array (ATCA). The ATCA observations described here cover the frequency range 4.5 - 41 GHz, which allows for the spectral index time variability to be examined. In this poster we give some examples of sources that have varying spectral indices, as well as some that do not show such behaviour. We also discuss the science possible with our data.

Doubling the Sample of Jet Speed Measurements for the TeV Blazars

V. C. Tiet (Whittier College), B. G. Piner (Whittier College), and P.G. Edwards (CSIRO Astronomy and Space Science, ATNF)

We report on our observations of the parsec-scale radio jet structures of five blazars that have been

detected by ground-based TeV gamma-ray telescopes. These five blazars all belong to the class of High-frequency peaked BL Lac objects (HBLs), which are the most common blazar type detected at the TeV energy range. Because of their relative faintness in the radio, these HBLs are not well represented in other radio blazar surveys. Our observations consist of five epochs of Very Long Baseline Array (VLBA) imaging from 2006 to 2009, of each of the five blazars 1ES 1101-232, Markarian 180, 1ES 1218+304, PG 1553+113, and H 2356-309, at frequencies from 5 to 22 GHz. Fundamental jet properties, including the apparent jet speeds, that can be measured from these multi-epoch series of VLBA images are presented and compared with other gamma-ray blazars. This study approximately doubles the number of TeV blazars with multi-epoch parsec-scale structural measurements.

Flaring Activity from S5 0836+71 (4C71.07): What Can We Learn with Limited Multiwavelength Coverage?

David J. Thompson, D. Donato (NASA/GSFC), A. Akyuz (Univ. of Cukorova), L. Fuhrmann, K. Sokolovsky (MPI for Radioastronomy), on behalf of the Fermi LAT Collaboration, O. Kurtanidze (Abastumani Observatory)

After a long period of quiescence in gamma rays, blazar S5 0836+71 (4C71.07), redshift z = 2.218, flared in the Spring of 2011. We found only limited multiwavelength coverage of the source. An indication of correlated optical/gamma-ray variability is not surprising for a FSRQ like this one. Radio observations at high frequencies, however, had seen a flare in late 2010, with no apparent related gamma-ray activity. This case may differ from the traditional pattern of finding gamma-ray flares during times of rising radio emission.

Observation of blazars with the high energy SED peak in the Fermi-LAT band

Gino Tosti (Universitat di Perugia/SLAC), Claudia Monte (INFN Bari), Luigi Costamante (no affiliation), Stefano Ciprini (INAF/ASI), Silvia Rain (INFN/Bari)

Among the AGN included both in the 1LAC and in the 2LAC, a particular and interesting group of objects is the one composed by those blazars that have their Spectral Energy Distribution (SED) high-energy peak centered on the Fermi-LAT band (from 20 MeV to 300 GeV). The brightest of these sources have been selected and they have been analyzed covering a period of 22 months of Fermi LAT gamma-ray data in order to investigate their spectral features in the gamma-ray band and to characterize the temporal evolution of their gamma-ray spectra.

The gamma-ray flaring properties of the blazar 3C 454.3

Stefano Vercellone (INAF/IASF Palermo) on behalf of the AGILE Team

3C 454.3 is the most variable and intense extragalactic gamma-ray blazar detected by AGILE and Fermi during the last 4 years. This remarkable source shows extreme flux variability (about a factor of 20) on a time-scale of 24-48 hours, as well as repeated flares on a time-scale of more than a year. The dynamic range, from the quiescence up to the most intense gamma-ray super-flare, is of about two orders of magnitude. We present the gamma-ray properties of 3C 454.3 by means of the available data, comparing both the characteristics of flares at different levels and their multi-wavelength behaviors. Moreover, an interpretation of both the long- and short-term properties of 3C 454.3 is reviewed, with particular emphasis on the two gamma-ray super-flares observed in 2009 and 2010, when 3C 454.3 became the brightest source of the whole gamma-ray sky.