Workshop on Blazar Variability across the Electromagnetic Spectrum

Rapport sur les contributions

https://indico.in2p3.fr/e/561

ID de Contribution: **0** Type: **Non spécifié**

blazars: the broad-band observational point of view

ID de Contribution: **1** Type: **Non spécifié**

blazars: the broad-band observational point of view

mardi 22 avril 2008 14:00 (45 minutes)

Orateur: Prof. CELOTTI, Annalisa

ID de Contribution: **2** Type: **Non spécifié**

Relativistic flows in active galaxies

mardi 22 avril 2008 14:45 (45 minutes)

Summary

I will consider some implications of the rapid X-ray and TeV variability observed in M87 and TeV blazars
for the dynamics and collimation of the associated jets. A particular attention will be given to the apparent conflict between the high Lorentz factors implied by opacity constraints and the small Lorentz factors inferred from radio observations, and the violent activity observed in the HST-1 knot in M87 that seems to indicate a very small emission zone at a large distance from the BH.
A model for jet focusing motivated by the above considerations will be described and employed to demonstrate that modest radiative cooling can lead to recollimation of a relativistic jet in a nozzle having a very small cross-sectional radius. Such a configuration can
produce rapid variability at large distances from the central engine in a low speed pattern.
I will also discuss other scenarios for the very rapid TeV flares observed with HESS and MAGIC in some blazars, that accommodate the relatively small Doppler factors inferred from radio observations.

Orateur: Prof. LEVINSON, Amir

ID de Contribution: **3** Type: **Non spécifié**

Pair production and cascades in AGN

mardi 22 avril 2008 16:00 (45 minutes)

Orateur: Prof. POUTANEN, Juri

ID de Contribution: **4** Type: **Non spécifié**

Can short variability time scales be reconciled with hadronic emission?

mardi 22 avril 2008 16:45 (45 minutes)

Summary

In extragalactic jets, protons and ions become radiatively efficient at ultrahigh energies providing a natural source of gamma rays. Hadronic emission can readily explain puzzling features of blazars at very high energies such as the orphan flares and the notoriously hard spectra that show up after taking into account pair attenuation in the metagalactic radiation field. The observed short variability time scales are challenging: they seem to require much stronger magnetic fields than those infered from fitting leptonic emission models to the blazar spectral energy distribution.
Simultaneous measurements of the synchrotron self-absorption turnover and the gamma ray peak of the flaring component could be used to resolve the ambiguities for the origin of the gamma rays. Owing to the multi-component nature of the jet emission, high-resolution observations are needed to pinpoint the flaring components and to identify the relevant turnover frequencies.

Orateur: Prof. MANNHEIM, Karl

ID de Contribution: **5** Type: **Non spécifié**

VLBI observations of blazars

mercredi 23 avril 2008 09:00 (45 minutes)

Summary

I will discuss 1) physical parameters (Lorentz and Doppler factors, viewing
and opening angles) of compact jets of blazars derived from intense VLBA monitoring at 7 mm; 2) variability of polarization in the core region of parsec scale radio jets, and 3) connections between 7 mm polarization
in the VLBI core and polarization at shorter wavelengths. The
sources show diversity in the physical parameters and polarization
behavior. I will discuss possible reasons for these differences.

Orateur: Prof. JORSTADT, Svetlana

ID de Contribution: **6** Type: **Non spécifié**

VLBI polarisation variability and implications for jet models

mercredi 23 avril 2008 09:45 (45 minutes)

Summary

For over 20 years, the variability of Active Galactic Nuclei (AGN)
on a wide range of time scales has often be interpreted in a shock paradigm, where the observed total-intensity and polarisation
variability is associated with the formation and propagation of shocks along the relativistic jets of these objects. While various types of
shock models have been successful at explaining the observed
variability, it remains difficult to conclusively demonstrate the
action of shocks in some cases. At the same time, a growing number of
AGN jets have now been found to show clear signs of helical magnetic
(B) fields, most strikingly the presence of Faraday-rotation gradients across their VLBI jets, due to the systematically changing line-of-sight
component of the B field across the jet. This compels us to take very
seriously the idea that many, possibly all, AGN jets have helical B fields, which, in fact, could come about very naturally as a consequence
of the joint action of rotation of the central black hole+accretion disc and the jet outflow. This suggests a new paradigm in which an underlying helical B field determines the "global" properties of the jets, while
the effects of relativistic shocks, and possibly interaction with the
surrounding medium, determine the local properties of individual regions in the jets. This retains shocks as a likely mechanism for much of the observed variability, although we should not exclude the possibility that some of this variability is associated with magnetic phenomena, such as reconnection. Various types of parsec-scale polarisation variability in AGNs will be briefly reviewed, including variability of their linear polarisations, circular polarisations, Faraday rotation measures and rotation-measure distributions.

Orateur: Prof. GABUZDA, Denise

ID de Contribution: **7** Type: **Non spécifié**

Total intensity radio variability in blazars

mercredi 23 avril 2008 11:00 (45 minutes)

Summary

Radio monitoring is the only method that can provide us with anything resembling fully sampled fluxcurves for a large number of sources. It is therefore an invaluable complement to virtually any observations, as it is the only method to establish in which state the source was at the epoch of observations: instead of a snapshot, we have a movie of what is going on. I will discuss the uses of total intensity radio monitoring both as a component of multiwavelength, multiapproach studies of AGN, and also as a powerful tool in itself. I pay particular attention to the nature or radio variations, correlations between radio variations and other observed phenomena, and radio variations as a tool for studying the fundamental parameters of AGN.

Orateur: Prof. VALTAOJA, Esko

ID de Contribution: **8** Type: **Non spécifié**

IR/optical/UV variability (photometric, spectral,polarization) in blazars

mercredi 23 avril 2008 11:45 (45 minutes)

Orateur: Prof. TOSTI, Gino

ID de Contribution: **9** Type: **Non spécifié**

thermal AGN signatures in Blazars

mercredi 23 avril 2008 14:00 (45 minutes)

Summary

Long ignored in blazars because of the dominance of the beamed radiation from the jet, the topic of thermal emissions is just beginning to be explored. While weak, there is a growing body of evidence that suggests that thermal components are observable in blazars. The emitting regions, which include the accretion disk as well as the torus, are key parts of the central engine which also powers the jets. They also may be of critical importance in helping us decide between unified scheme models. We will review the observational evidence for thermal emissions in blazars, with an emphasis on recent work, and the spectral and variability characteristics that have been observed. We discuss how one can distinguish between broad-band emissions from thermal and nonthermal sources, and how these different components can impact the broad and narrow line regions. Finally, we will assess the current standing of unified scheme models as respects thermal signatures.

Orateur: Prof. PERLMAN, Eric

ID de Contribution: **10** Type: **Non spécifié**

Long-term X-ray variability in blazars and its multiwaveband context

mercredi 23 avril 2008 14:45 (45 minutes)

Summary

Since the X-ray emission from blazars is variable on all time-scales, long-term monitoring is required to characterize it and relate it to the physics of the relativistic jets. The best approach involves comprehensive multiwaveband observations. These include (1) millimeter-wave VLBI to image the structure of the jet and magnetic field on the smallest possible scales, (2) optical polarization so that features on the VLBI images with unique polarization direction can be associated with the variable optical emission, and (3) light curves for cross-frequency correlation analysis. The author and his collaborators have been carrying out such an effort over a number of years. The results thus far are very revealing, and promise to be more so during the next several years when GLAST will be producing very well sampled gamma-ray light curves for many blazars.

Orateur: Prof. MARSCHER, Alan

ID de Contribution: **11** Type: **Non spécifié**

HE gamma-ray variability, what we know, where we will know more

mercredi 23 avril 2008 16:00 (45 minutes)

Orateur: Dr MCENERY, Julie

ID de Contribution: **12** Type: **Non spécifié**

Variability of Very High Energy Gamma-ray Blazars

mercredi 23 avril 2008 16:45 (45 minutes)

The third generation of Very High Energy (VHE; E>100 GeV) gamma-ray telescopes (e.g. HESS, VERITAS & MAGIC)
are an order of magnitude more sensitive than their predecessors. Over the past four years observations with these instruments
have increased the catalog of VHE emitters to more than 70 sources, of which 22 are extragalactic.
While only limited variability is found from the 15 newly discovered VHE blazars, the more sensitive studies of
the 7 previously known extragalactic VHE emitters (6 blazars & the radio-galaxy M 87) have yielded unprecedented
results. Recent highlights include the discovery of minute-scale VHE flux variability, significant VHE spectral changes on
sub-hour time-scales, and strong correlations of these rapid VHE variations (flux & spectrum) with those
simultaneously observed at X-ray energies. A summary of the variability properties of VHE blazars will be presented.

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Orateur: Dr BENBOW, Wystan

ID de Contribution: **13** Type: **Non spécifié**

Workshop Cocktail‼

mercredi 23 avril 2008 19:00 (2 heures)

ID de Contribution: **14** Type: **Non spécifié**

Correlations within/between the two radiative populations

jeudi 24 avril 2008 09:00 (45 minutes)

Summary

Blazars are thought to emit highly-collimated outflows, so-called jets. By their close alignment to our line of sight, relativistic beaming effects enable us to observe these jets over the whole electromagnetic spectrum up to TeV energies, making them ideal laboratories for studying jet physics. In the last years multiwavelength observations of blazars provided us with detailed data sets which helped to characterize the two main components of the non-relativistic emission, peaking in the optical to X-ray and GeV/TeV energy region, respectively. In leptonic acceleration models, they are explained by synchrotron radiation of electrons and Inverse-Compton emission from the same electron population and thus, correlations of both emission regimes are expected. In the presentation, recent oservational results on the presence and absence of such correlations in blazars are reviewed, and constraints on emission models by quantitative correlation analyses are discussed.

Orateur: Dr ROBERT, Wagner

ID de Contribution: **15** Type: **Non spécifié**

Characterising X-Ray Variability in Blazars

jeudi 24 avril 2008 09:45 (45 minutes)

Summary

Historically blazar research has tended to concentrate on individual 'outbursts'. In many respects this approach has been successful, particularly when considering the relationship between the emission at different wavebands, and the likely emission mechanisms. But does this approach properly address the underlying reason behind the variability? In all other accreting systems, eg X-ray binary sources or non-blazar active galaxies such as Seyfert galaxies, it it now reasonably well established that the X-ray variability is the result of a red-noise process. In those cases it is likely that the variability arises in the accretion disc, eg as accretion rate fluctuations. These variations propogate inwards and eventually modulate the X-ray emission region. Could something similar be happening in blazars? In this talk I consider the possibilities.

Orateur: Prof. MCHARDY, Ian

ID de Contribution: **16** Type: **Non spécifié**

Characterizing X-ray Variability of TeV blazars

jeudi 24 avril 2008 11:00 (45 minutes)

Summary

In this talk, I will briefly overview the synchrotron X-ray variability of TeV blazars by focusing how to extract “jet physics” from the observed light curves. Apparently, the light curve gives independent and complementary information to the spectral energy distribution, but surprisingly little attention
has been paid especially for the blazar study. Various temporal techniques are given in literature, e.g., the discrete correlation function (DCF), the structure function (SF), and the power spectrum density (PSD) analysis, but special care must be taken if the data is not well sampled and relatively short compared to the variability time-scale of the system. For example, there was a beautiful paradigm that the soft X-ray variation of TeV blazars lag behind
the hard X-rays by ~5 ksec, reflecting the difference of synchrotron cooling time-scale. However, the situation is being more and more complicated if we properly consider the effects caused by periodic gap in the light curve due to the Earth occultation (every ~ 6ksec). I will present detailed simulations to see how the “gap” and the “length” of the data affects the results of temporal
analysis, and to what extent we can be sure of our results. I will also briefly present some recent highlights from Suzaku observations of TeV blazars.

Orateur: Prof. KATAOKA, Jun

ID de Contribution: **17** Type: **Non spécifié**

The variability of blazars viewed as a random stationary process: the case of PKS2155-304 with Atmospheric Cherenkov Telescopes

jeudi 24 avril 2008 11:45 (45 minutes)

Summary

With the advent of the new generation of Cherenkov telescopes such as H.E.S.S., MAGIC, CANGAROO III and VERITAS, about 20 active galactic nuclei belonging to the blazar category have been clearly detected at very high energies. Spectacular flares were observed in a few of them, such as Mkn 421, Mkn 501 and PKS 2155-304, during which gamma-ray fluxes could be sampled with time intervals of a few minutes, an important asset in the quest of a smallest time-scale in the underlying phenomena. In the very-high-energy domain, the experimental situation is however more tricky than in blazar variability studies carried out by X-ray satellites: the time resolution critically depends on the flux itself, due to both photon statistics and background contamination, and the continuous time series are never longer than a few hours. Nevertheless, a description of the observed phenomena by a random stationary process characterized by a simple power density spectrum —a power law of frequency —can be investigated. Such a study requires simulations of very long time series in which the experimental effects are taken into account. Using H.E.S.S. observations of PKS 2155-304 in July 2006, it is shown that different observables, namely excess variances measured over different durations as well as Kolmogorov structure functions, can be consistently accounted for by a simple log-normal process. Prospects in this field opened by future large arrays of Cherenkov telescopes are also discussed.

Orateur: Prof. DEGRANGE, Bernard

ID de Contribution: **18** Type: **Non spécifié**

particle acceleration mechanisms and variability in relativistic flows (stochastic processes, shocks, magnetic reconnection, matter/radiation dominated scenarios)

jeudi 24 avril 2008 14:00 (45 minutes)

Orateur: Prof. KIRK, John

ID de Contribution: **19** Type: **Non spécifié**

A unified time-dependant view of relativistic jets

jeudi 24 avril 2008 14:45 (45 minutes)

Summary

High quality, time resolved observations, of blazars at VHE energy allow detailed comparisons with time dependant models, especially when they are accompanied with simultaneous multiwavelengths campaigns. They provide then strong constraints on emission mechanisms. We will argue that recent data obtained on PKS 2155 favour a stratified jet model , where a perturbation propagates along the jet, producing correlated, but not simultaneous variability at various wavelengths. A stratified jet helps also lessening the constraints on gamma-ray opacity, since low energy photons can be emitted farther away in the jet and do not contribute to gamma-ray absorption. We will detail more specifically a model based on variable electron-positron pair creation at the base of a relativistic jet, and show that it can reproduce most of the features observed in multi wavelengths observations. The bulk Lorentz factors deduced from this models are significantly lower than those deduced from one zone models, but still higher than those deduced from previous FRI - BL lacs unification models. We will also discuss the implications of these results on the geometry of the jet.

Orateur: Prof. HENRI, Gilles

ID de Contribution: **20** Type: **Non spécifié**

Multiwavelength Synchrotron/Compton Spectral Analysis of TeV Blazars and FSRQs: A New Approach

jeudi 24 avril 2008 16:00 (45 minutes)

Summary

We present a new method to analyze multiwavelength data from blazars. By assuming the radio through X-ray flux is nonthermal synchrotron emitted by isotropically-distributed electrons in the randomly oriented magnetic field of a relativistic jet, one obtains the electron spectrum. This spectrum is then used to deduce the Compton spectrum as a function of a small set of parameters. Photoabsorption of gamma rays interacting with photons from internal jet radiation, local radiation fields, and the extragalactic background light (EBL) is included. We find that a one zone synchrotron self-Compton model is unlikely to explain the very high energy gamma-rays from the 2006 flare detected in the X-ray selected BL Lac PKS 2155-304, with implications for external radiation fields in the black hole/jet environment. We also present calculations of Compton-scattered accretion-disk and central source radiation scattered by broad line region material using the full Compton cross-section, with a self-consistent treatment of gamma-gamma opacity.

Orateur: Prof. DERMER, Chuck

ID de Contribution: **21** Type: **Non spécifié**

Radiative outputs from blazars (radiative processes, escape, light crossing, KN effects, emphasis on what we learn from the synchrotron bump about the underlying particle distributions).

jeudi 24 avril 2008 16:45 (45 minutes)

Orateur: Dr MODERSKI, Rafal

ID de Contribution: **22** Type: **Non spécifié**

propagation effects in VHE gamma-rays: the physics, how to find them (e.g. Quantum gravity effects, Lorentz invariance violations..)

jeudi 24 avril 2008 17:30 (45 minutes)

Orateur: Prof. WAGNER, Stefan

ID de Contribution: **23** Type: **Non spécifié**

Unification scenarios: the case of M87

vendredi 25 avril 2008 09:00 (45 minutes)

Orateur: Dr SOL, Hélène

ID de Contribution: **24** Type: **Non spécifié**

The next generation of X-ray sensitive space-based observatories and their potential for blazar variability studies

vendredi 25 avril 2008 09:45 (45 minutes)

Summary

Blazars are clearly variable in all spectral bands, and their variability places additional constraints on their structure and emission processes. This presentation covers the current results and future opportunities regarding variability of blazars as measured in the X-ray band. In particular, it highlights recent results from observations with the Asca, RXTE, XMM, and Suzaku satellites, and discusses the potential for studies of X-ray variability (including observational constraints, and anticipated results) from broad-band studies in the GLAST era. It also discusses the future missions - such as NuSTAR, NeXT, and Con-X - that are likely to provide new insight on blazar structure, especially via the new data resulting from sensitive time-resolved observations in the hard X-ray band.

Orateur: Dr MADEJSKI, Greg

ID de Contribution: **25** Type: **Non spécifié**

Strengths and limitations of ACTs (present and future) for transient VHE sources

vendredi 25 avril 2008 11:00 (45 minutes)

Orateur: Dr PUNCH, Michael

ID de Contribution: **26** Type: **Non spécifié**

Summary talk, what have we learned, outstanding questions

vendredi 25 avril 2008 11:45 (45 minutes)

Orateur: Dr KAARET, Philip

ID de Contribution: **27** Type: **Non spécifié**

Highlight: new results from AGILE on blazars

jeudi 24 avril 2008 18:15 (20 minutes)

Orateur: Dr TAVANI, Marco