The Blazar Times

A Research Newsletter Dedicated to the BL Lac and Blazar Phenomena

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The detection of TeV γ-rays from the blazar H 1426+428 at an integral flux level of $(4\pm2_{\rm stat}\pm1_{\rm syst})\times10^{-12}{\rm erg\,cm^{-2}s^{-1}}$ above 1 TeV with the HEGRA imaging atmospheric Cherenkov telescope system is reported. H 1426+428 is located at a redshift of z=0.129, which makes it the most distant source detected in TeV γ-rays so far. The TeV radiation is expected to be strongly absorbed by the diffuse extragalactic background radiation (DEBRA). The observed energy spectrum of TeV photons is in good agreement with an intrinsic power law spectrum of the source $\propto E^{-1.9}$ corrected for DEBRA absorption. Statistical errors as well as uncertainties about the intrinsic source spectrum, however, do not permit strong statements about the density of the DEBRA infrared photon field.

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Four Years Monitoring of Blazar PKS 2155–304 with *BeppoSAX* : Probing the Dynamics of the Jet

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PKS 2155–304 is one of the brightest blazars in the X-ray band. It was repeatedly monitored with *BeppoSAX* during three long campaigns of about 2 days each in November of 1996, 1997 and 1999. The source underwent different states of intensity and was clearly variable with successive flares detected. This paper presents temporal and spectral analysis to study the X-ray variability trends for a blazar. The variability shows larger amplitude and shorter timescale at higher energies. The power spectral densities have steep power-law slopes of ~ 2–3, indicating shot noise variability. Structure function analysis reveals the existence of "typical" timescales characteristic of the half duration of the flares. From the cross-correlation analysis we find that the values of soft lags, i.e., delays of soft (0.1–1.5 keV) photons with respect to hard (3.5–10 keV) ones, differ from flare to flare, ranging from a few hundred seconds to about one hour. There is a suggestion that the flares with shorter duration show smaller soft lags. The soft lags are also energy-dependent, with longer lags of lower energy emission with respect to the emission in the 4–10 keV. The time-resolved X-ray spectral fits with a curved model show that peak energies of the synchrotron component are located in the very soft X-ray range or even below the *BeppoSAX* lower energy limit, 0.1 keV. A correlation between peak energies and fluxes is marginal. Spectral evolution during some flares shows clockwise loops in the spectral index–flux plane, confirming the soft lags indicated by the cross-correlation analysis. Two flares, however, show evidence that spectral evolution follows opposite tracks in the soft and hard energy bands, respectively. The rich phenomenology is interpreted in the context of a model where relativistic electrons are accelerated through internal shocks taking place in the jets. The most important parameter turns out to be the initial time interval between the two shells ejected from the central engine to produce the flare, which may determine the structure of the shock and in turn the physical quantities of the emitting region to reproduce the observed trends of the X-ray variability.

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Detection of the BL Lac Object 1H1426+428 at TeV Gamma Ray Energies

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A very high energy γ-ray signal has been detected at the 5.5σ level from 1H1426+428, an x-ray selected BL Lacertae object at a redshift of 0.129. The object was monitored from 1995 - 1998 with the Whipple 10m imaging atmospheric Čerenkov telescope as part of a general blazar survey; the results of these observations, although not statistically significant, were consistently positive. X-ray observations of 1H1426+428 during 1999 with the *Beppo*SAX instrument revealed that the peak of its synchrotron spectrum occurs at > 100 keV, leading to the prediction of observable TeV emission from this object. 1H1426+428 was monitored extensively at the Whipple Observatory during the 1999, 2000, and 2001 observing seasons. The strongest TeV signals were detected in 2000 and 2001. During 2001, an integral flux of 2.04 ± 0.35 x 10^{-11} cm^{-2} s^{-1} above 280 GeV was recorded from 1H1426+428. The detection of 1H1426+428 supports the idea that, as also seen in Markarian 501 and 1ES2344+514, BL Lacertae objects with extremely high synchrotron peak frequencies produce γ-rays in the TeV range.

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X-ray Synchrotron Spectral Hardenings from Compton and Synchrotron Losses in Extended Chandra Jets

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Chandra observations of knots and hot spots in spatially resolved X-ray jets of radio galaxies show that the X-ray fluxes often lie above an extrapolation from the radio-to-optical continuum fluxes. We show that combined synchrotron and Compton losses on a single power-law electron injection function can produce a hardening in the electron spectrum at electron Lorentz factors $\gamma \approx 2 \times 10^8/[\Gamma(1+z)]$ due to KN energy losses on the cosmic microwave background radiation. Here Γ is the bulk Lorentz factor of the outflow, and z is the source redshift. This produces a flattening in the spectrum at frequencies $> 8 \times 10^{16} \delta B_{\mu\rm G}/[\Gamma^2(1+z)^3]$ Hz, where $B_{\mu\rm G}$ is the magnetic field in the comoving plasma frame in units of micro-Gauss and δ is the Doppler factor. A single population of synchrotron-emitting electrons may therefore produce the radio-to-X-ray continuum in some radio galaxy knots, such as those in 3C 273.

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Abstract Guidelines

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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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