SED catalog of southern blazars

F. Krauß[1,2], J. Wilms[1], M. Kadler[2], R. Ojha[3,4,5], T. Beuchert[1,2], B. Carpenter[5], C. Gräfe[1,2], A. Kreikenbohm[1,2], M. Langejahn[2], K. Leiter[1,2], C. Müller[2,1], E. Ros[6,7], R. Schulz[2,1], J. Trüstedt[2], *on behalf of the TANAMI and the Fermi-LAT Collaborations*

[1] Remeis-Observatory & ECAP/FAU, Germany, [2] Universität Würzburg, Germany, [3] NASA, GSFC, USA, [4] University of Maryland, Baltimore, USA, [5] Catholic University of America, Washington, DC, USA, [6] Max-Planck-Institut für Radioastronomie, Bonn, Germany, [7] Universitat de València, València, Spain

Aim

The TANAMI project conducts multiwavelength observations of a flux-limited sample of ~90 AGN on the southern sky (Ojha et al. 2010). We make use of the continuous gamma-ray monitoring by *Fermi*-LAT as well as dedicated radio to X-ray monitoring to compile a catalog of blazar broadband spectral energy distributions (SEDs) using quasi-simultaneous data. We study changes in the shape of the SED for many sources and amongst other investigations, probe the blazar sequence.

Gamma-rays: *Fermi*-LAT light curve

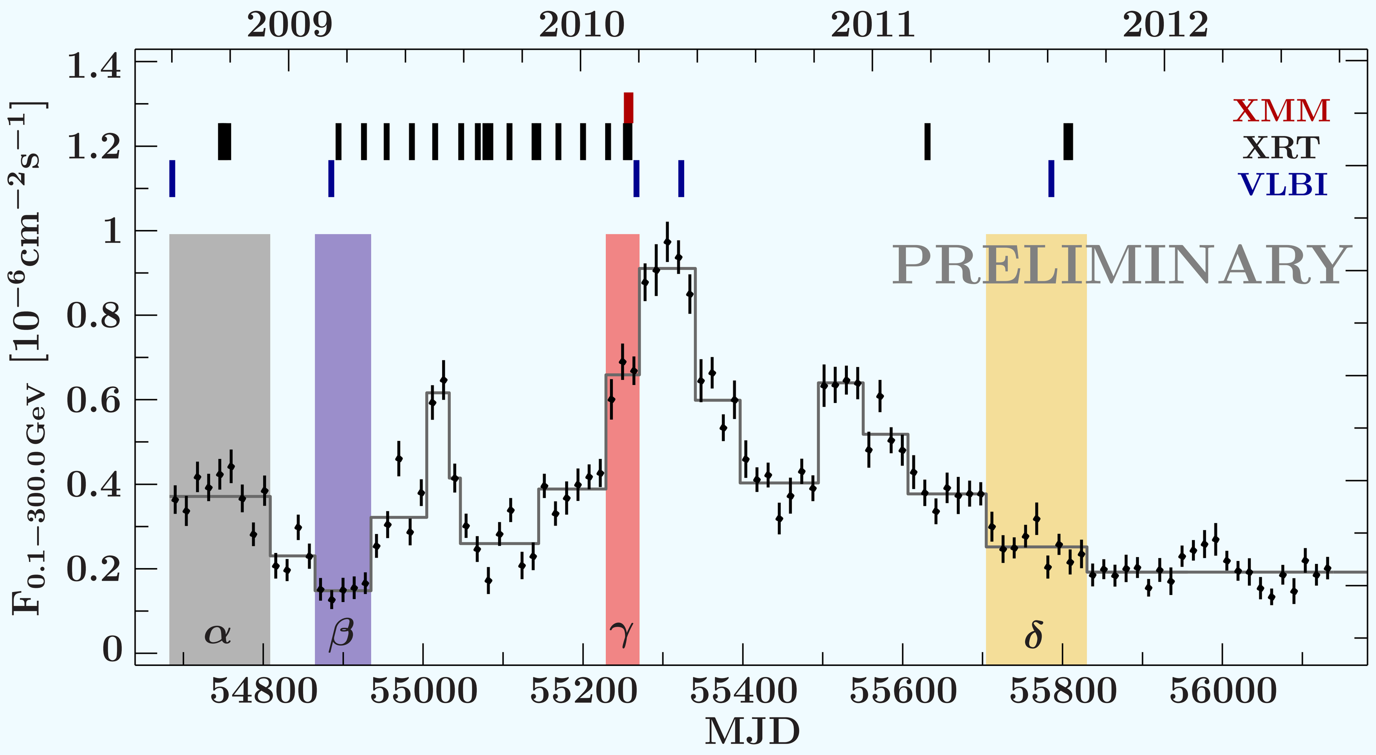

Fig. 1 *Fermi*-LAT light curve of PKS 0537−441, also showing where *Swift*/XRT, *XMM-Newton* and VLBI data are available. Quasi-simultaneous states are marked in color.

Bayesian Blocks

To determine the time ranges for compiling quasi-simultaneous data, we use a Bayesian Block algorithm (Scargle et al. 2013). It calculates change points, at which the flux is no longer consistent with being constant. The time ranges between change points are called blocks and only quasi-simultaneous data within a block are used. Blocks can be determined in the *Fermi*-LAT light curve due to the continuous monitoring. Only those blocks (and time ranges) are chosen where X-ray data in the same, and VLBI data in the same or adjacent block are available.

Radio: VLBI images

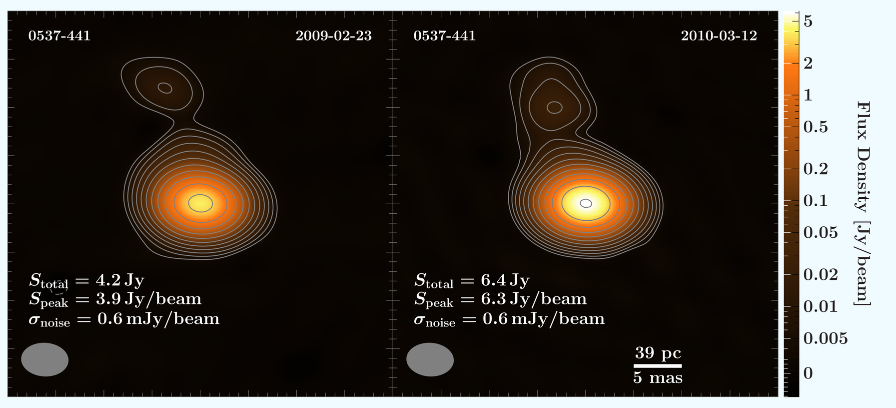

Fig. 2 shows the parsec-scale VLBI images at 8.4 GHz with a restoring beam of 4.9 mas × 3.4 mas (gray ellipse) for the two time ranges β and γ in Fig. 1. At radio wavelengths we see an increase in brightness contained within the central few parsec.

X-ray/Optical

We perform spectral fitting to the combined X-ray data with an absorbed powerlaw. The absorbing column is used to determine the extinction and correct the IR - UV data (Nowak et al. 2012, and references therein). For the X-ray absorption, we use the tbnew absorption model with the `vern` cross-sections (Verner et al. 1996) and `wilm` abundances (Wilms et al. 2000).

Broadband fitting

The broadband spectra are fit with two log parabolas (Massaro et al. 2004), the X-ray absorption, and reddening. The absorbing column and reddening are frozen to the value determined by the X-ray spectral fitting. The X-ray (*Swift*/XRT and *XMM-Newton*) and *Swift*/UVOT data are fit in detector space, they are not unfolded before fitting. This allows us to determine if a higher absorption significantly improves the fit.

Fig. 4 shows the SED for PKS 0537−441 with the four quasi-simultaneous states marked in Fig. 1. Archival data from the Planck, 2MASS (Skrutskie et al. 2006), WISE (Wright et al. 2010, Mainzer et al. 2011), BAT, INTEGRAL and 3FGL (Fermi-LAT Collaboration 2015) catalog are shown in light purple. The gray data points are reddened.

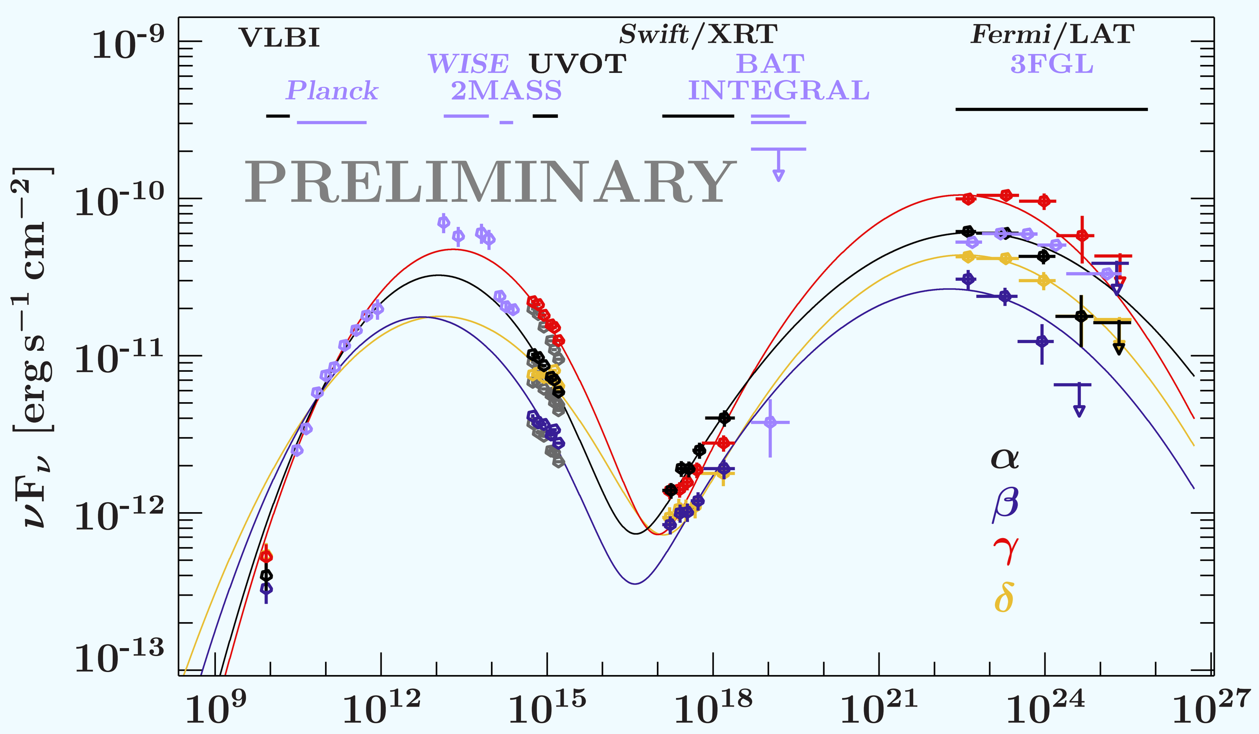

Fig. 4 Broadband SEDs of PKS 0537−441 for the time ranges marked in Fig. 1, with additional non-simultaneous archival data marked in light purple.

References

Massaro et al. 2004, A&A, 413, 489
Mainzer et al. 2011, ApJ, 731, 53
Nowak et al. 2012, ApJ, 759, 95
Ojha et al. 2010, A&A, 519, A45
Scargle et al. 2013, ApJ, 764, 167
Skrutskie et al. 2006, AJ, 131, 1163
Fermi-LAT Collaboration 2015, ApJ, in press, arXiv:1501.02003
Verner et al. 1996, ApJ, 465, 487
Wilms et al. 2000, ApJ, 542, 914
Wright et al. 2010, AJ, 140, 1686

For more information, please contact Felicia.Krauss@fau.de and visit http://www.sternwarte.uni-erlangen.de/~krauss