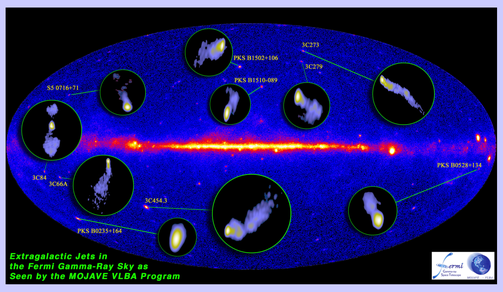

The relation between radio polarization and gamma-ray emission in AGN jets

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By combining 15 GHz VLBA data and Fermi LAT detections of AGN jets, we find that the polarization properties of the LAT-detected and non-LAT-detected AGN samples are significantly different.

I. Abstract

We have compared the milliarcsecond jet linear polarization properties of the Fermi LAT-detected and non-detected sources in the complete flux-density-limited (MOJAVE-1) sample of highly beamed AGN. We find that the unresolved core components of the LAT-detected jets have significantly higher polarization levels at 15GHz.

II. The Sample

- Parsec scale jet properties from a complete flux-density-limited MOJAVE-1 (Monitoring Of Jets in Active galactic nuclei with VLBA Experiments) sample of 135 sources (Lister et al. 2009a).
- Fermi Large Area Telescope (LAT) detections from the first 3 months of LAT operations (Abdo et al. 2009).
- Only sources with galactic latitude |b| > 10
- 123 MOJAVE sources from which 30 are detected by LAT

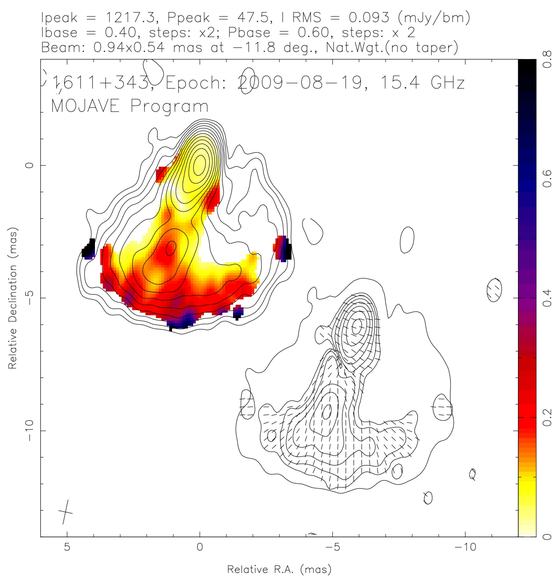

Fig.1. MOJAVE image of the source 1611+343. The left hand image shows total intensity contours with colors indicating fractional polarization. The right hand image shows the lowest total intensity contour and polarization contours. Sticks indicate electric vector position angles.

III. Polarization Observations

- VLBA observations at 15 GHz
- Epochs including polarimetric observations
- Total intensity, polarized flux density, fractional polarization and Electric Vector Position Angles (EVPAs) calculated for all core components

Acknowledgements

The authors wish to acknowledge the contributions of the MOJAVE team: H. and M. Aller, T. Arshakian, M. Cohen, D. Homan, M. Kadler, K. Kellermann, A. Lobanov, E. Ros, R. Vermeulen, A. Zensus. The MOJAVE project is supported under National Science Foundation grant 0406923-AST. This work is supported under NASA Fermi Grant NNX08AV67G.

IV. Polarization levels

Q1: Are LAT detected blazars more polarized?

A1: Yes, Fig. 2. shows the distributions of maximun polarized core flux density since August 2008

Q2: Is this because they are in active state?

A2: Yes, in Fig. 3. we compare the median polarization levels of epochs prior to LAT (2002-August 2008) and during LAT observations (since August 2008). No differences are seen in the medians before LAT (p=0.35) but there is a significant difference in the medians since August 2008 (p=0.013).

- No differences in the distributions of the offset between EVPA and jet position angle are seen.
- Similar results were obtained by Lister & Homan (2005) using MOJAVE and EGRET data.

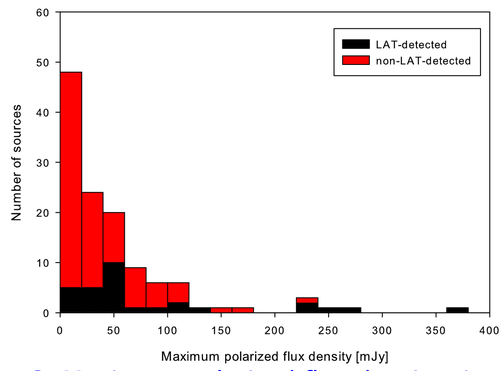

Fig. 2. Maximum polarized flux density since August 2008. Nine values in the smallest bin of non-detected sources are upper limits. Significant difference is seen between the groups (p>99.9%)

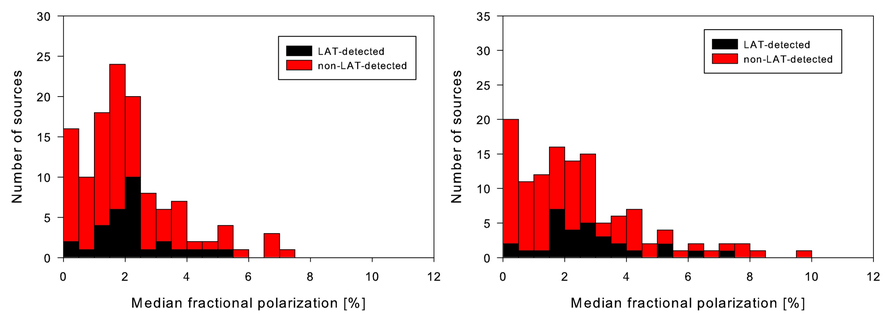

Fig. 3. Distributions of the median fractional polarization from 2002 until August 2008 (left panel) and since August 2008 (right panel). Differences are not seen in the archival values (p=0.35) but values for LAT-detected and non-detected sources since August 2008 differ significantly (p=0.013).

V. Variability Indices

- Calculated using all MOJAVE data since 2002 in the same way as in Aller et al. (2003) and Jorstad et al. (2007) by taking the rms-values into account.
- Variability indices of fractional polarization in LAT-detected and non-LAT-detected sources are significantly different (Fig. 4). There are no low-variability sources detected by the LAT.
- Similar difference is seen in the variability indices of EVPAs (Fig. 5).

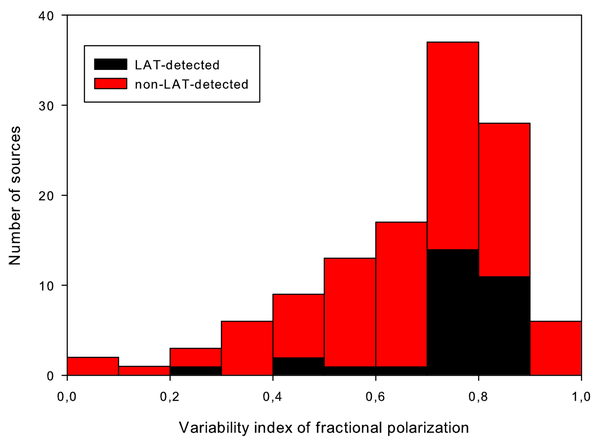

Fig. 4. Significant difference (K-S test p 99%) between LAT-detected and non-detected sources is seen.

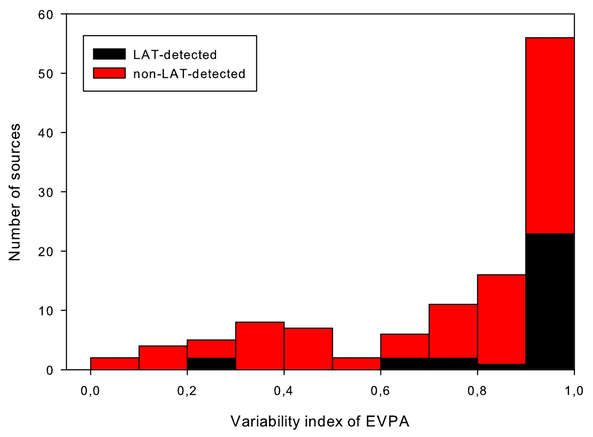

Fig. 5. Significant difference (K-S test p 99.9%) between LAT-detected and non-detected sources is seen.

VI. Discussion

- By comparing the median fractional polarization since August 2008 with archival median values between 2002 and 2008, we find the sources to be in a more active polarization state when detected by the LAT. This complements our previous findings that these LAT sources have higher apparent jet speeds, brightness temperatures, and are preferentially found in higher activity states (Kovalev et al. 2009a,b, Lister et al. 2009b).
- By using the intrinsic viewing angles of the sources (Savolainen et al. 2009, in preparation) we find that the fractional polarization levels can possibly be explained with the simple shock models of Hughes, Aller & Aller (1985) and Wardle et al. (1994).
- The next step is to study the correlations between polarization properties and gamma-ray luminosity from the LAT 1-year catalog. We will study if the gamma-ray flares correspond to changes in the 15 GHz core properties as was detected in the case of the quasar PKS 1502+106 (Abdo et al. 2009b).

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