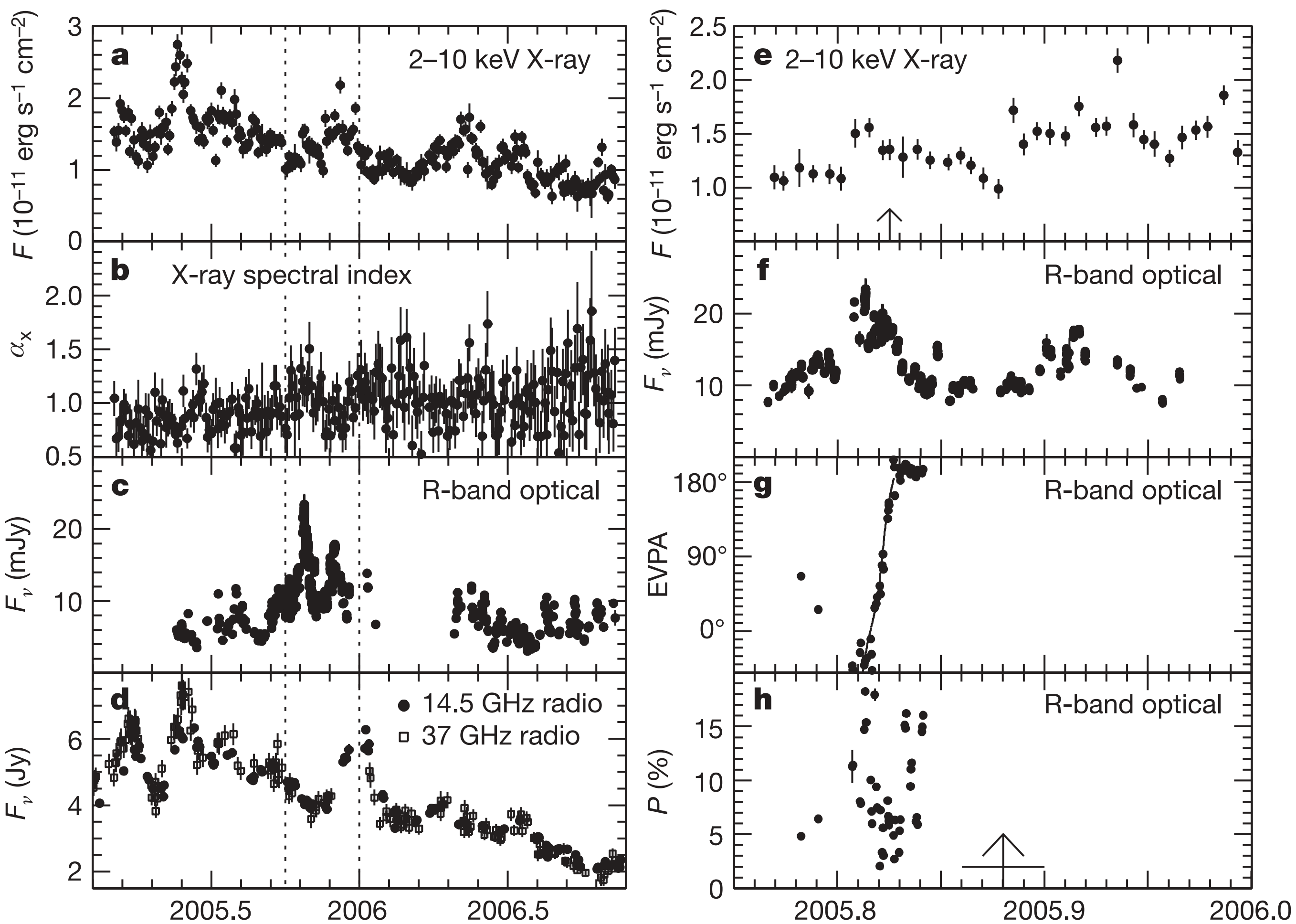
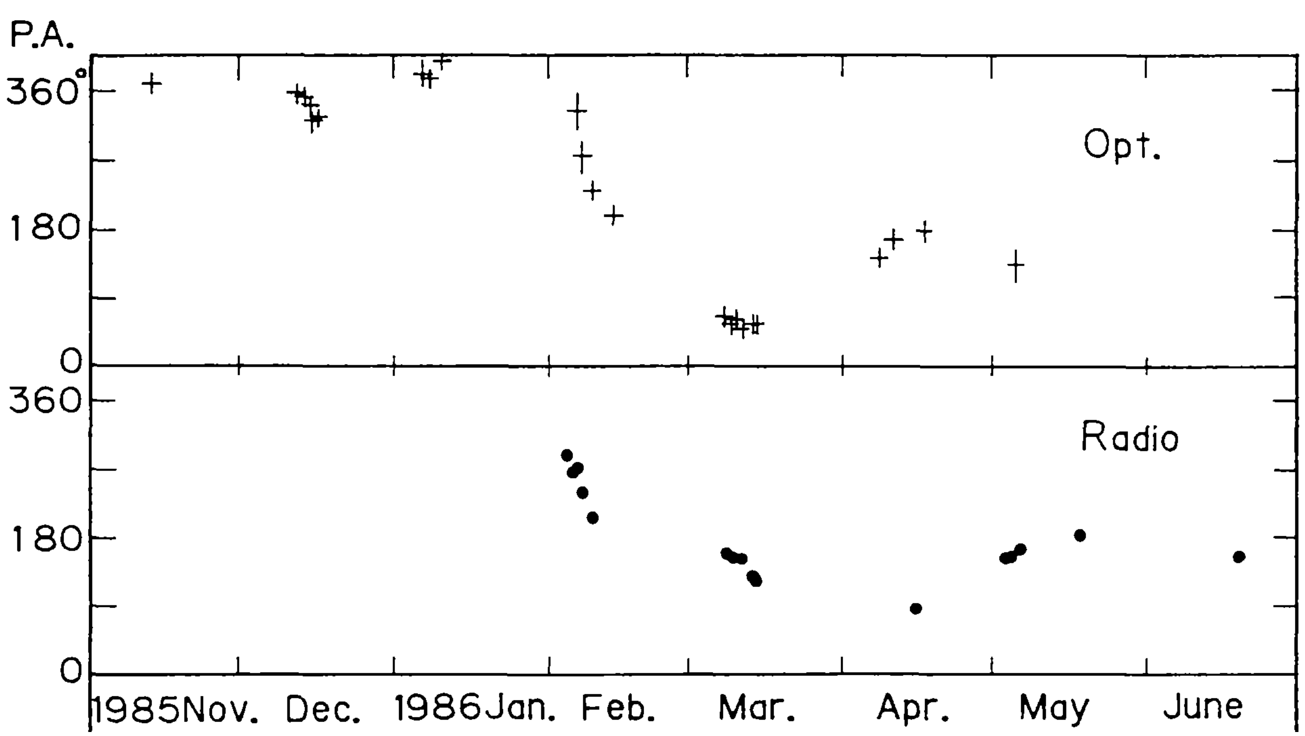
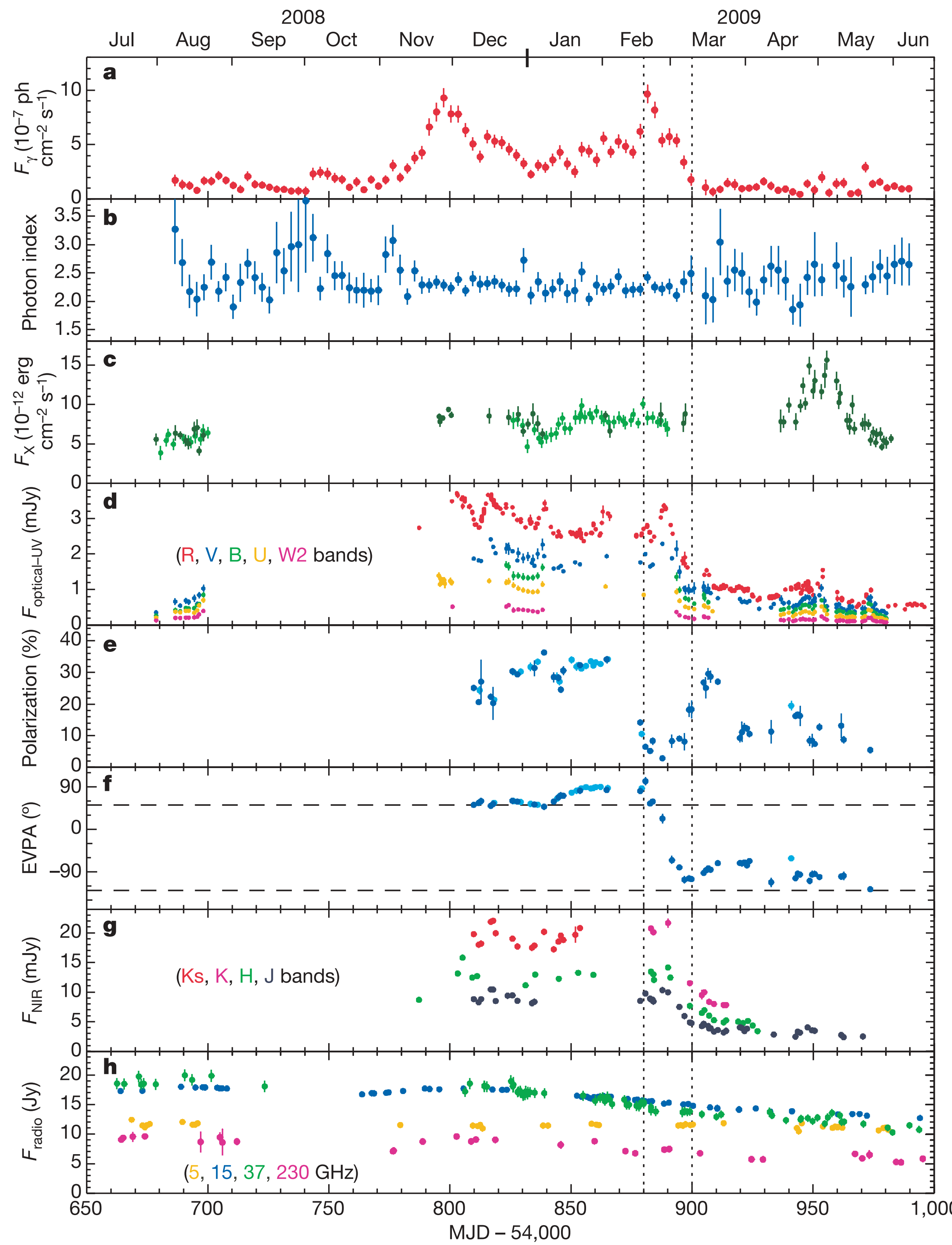


Marscher et al. 2008, Nature 452, 966



Kikuchi et al, 1980, A&A, 190, L8



Abdo et al. 2010, Nature 463, 919

RoboPol: the optical polarisation of a γ-ray flux limited sample of AGN

Emmanouil Angelakis[1]

D. Blinov[2,3], V. Pavlidou[2,3], T. Hovatta[4], I. Myserlis & the RoboPol collaboration

[1]Max-Planck-Institut fuer Radioastronomie, Auf dem Huegel 69, 53121 Bonn, Germany
[2]Foundation for Research and Technology - Hellas, IESL, Voutes, 7110 Heraklion, Greece
[3]Department of Physics and Institute for Plasma Physics, University of Crete, 71003, Heraklion, Greece
[4]Aalto University Metsahovi Radio Observatory, Metsahovintie 114, 02540 Kylmala, Finland

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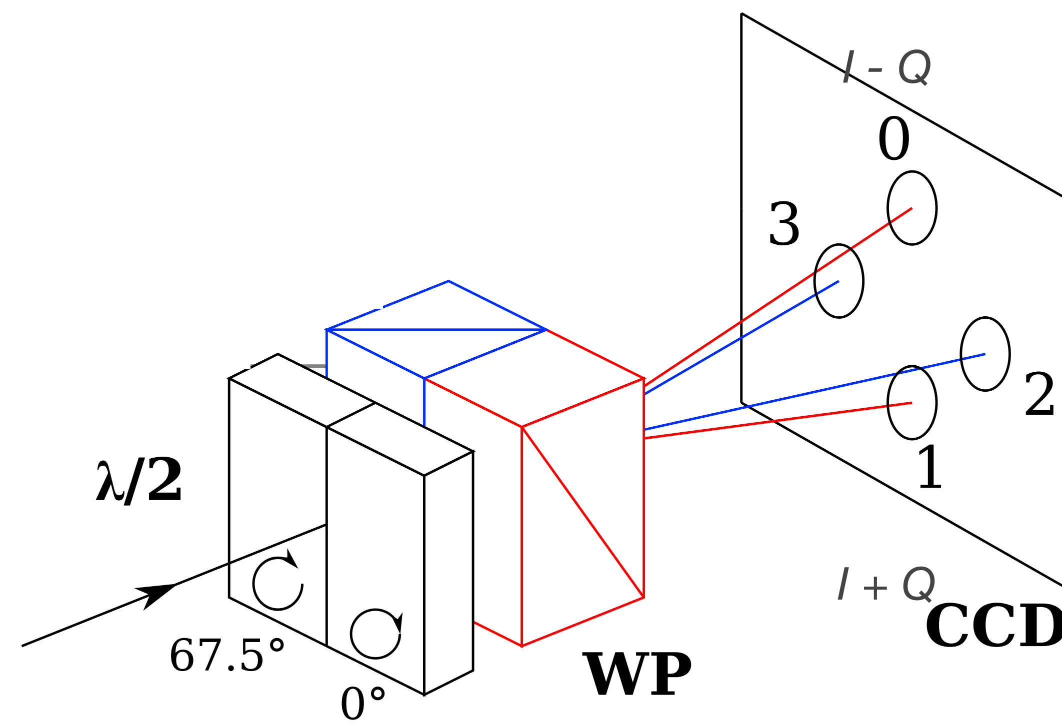
the **RoboPol** program

Pavlidou, EA et al. 2014, MNRAS, 442, 1693

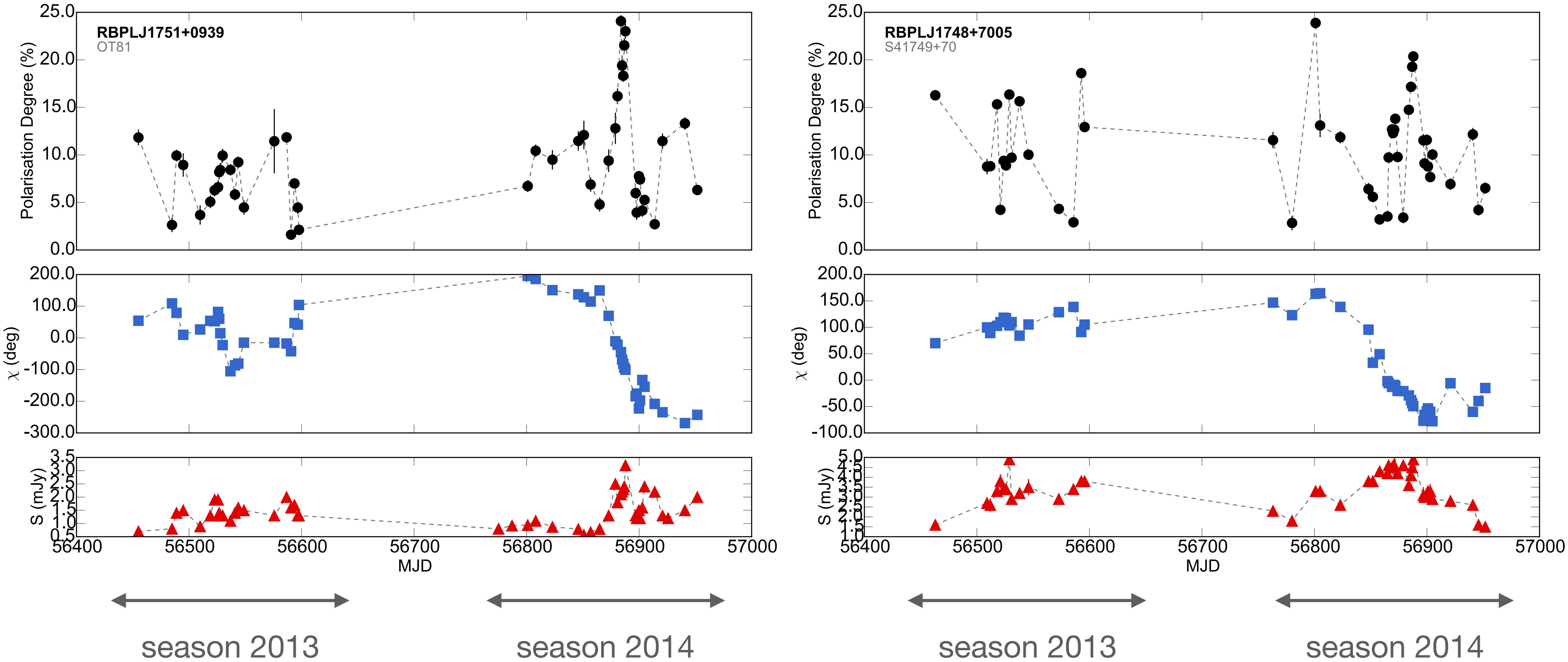
- ➡ unbiased samples:
  - 65 GL sources: from 2FGL
  - 15 GQ sources: variable in radio
- ➡ adaptive cadence: 3 - 0.3 nights
- ➡ 4-channel RoboPol polarimeter

  King et al. 2014, MNRAS, 442, 1706

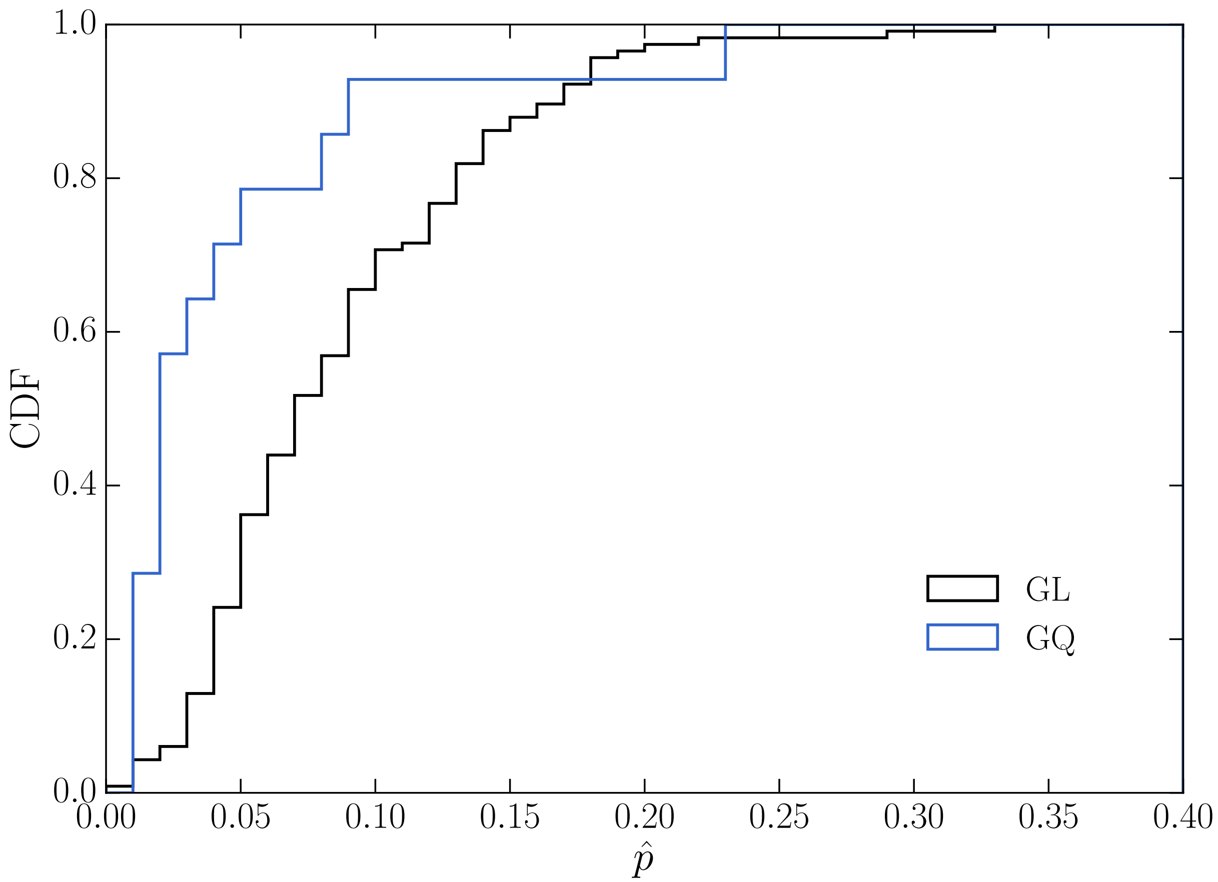
  Ramaprakesh et al., in prep.

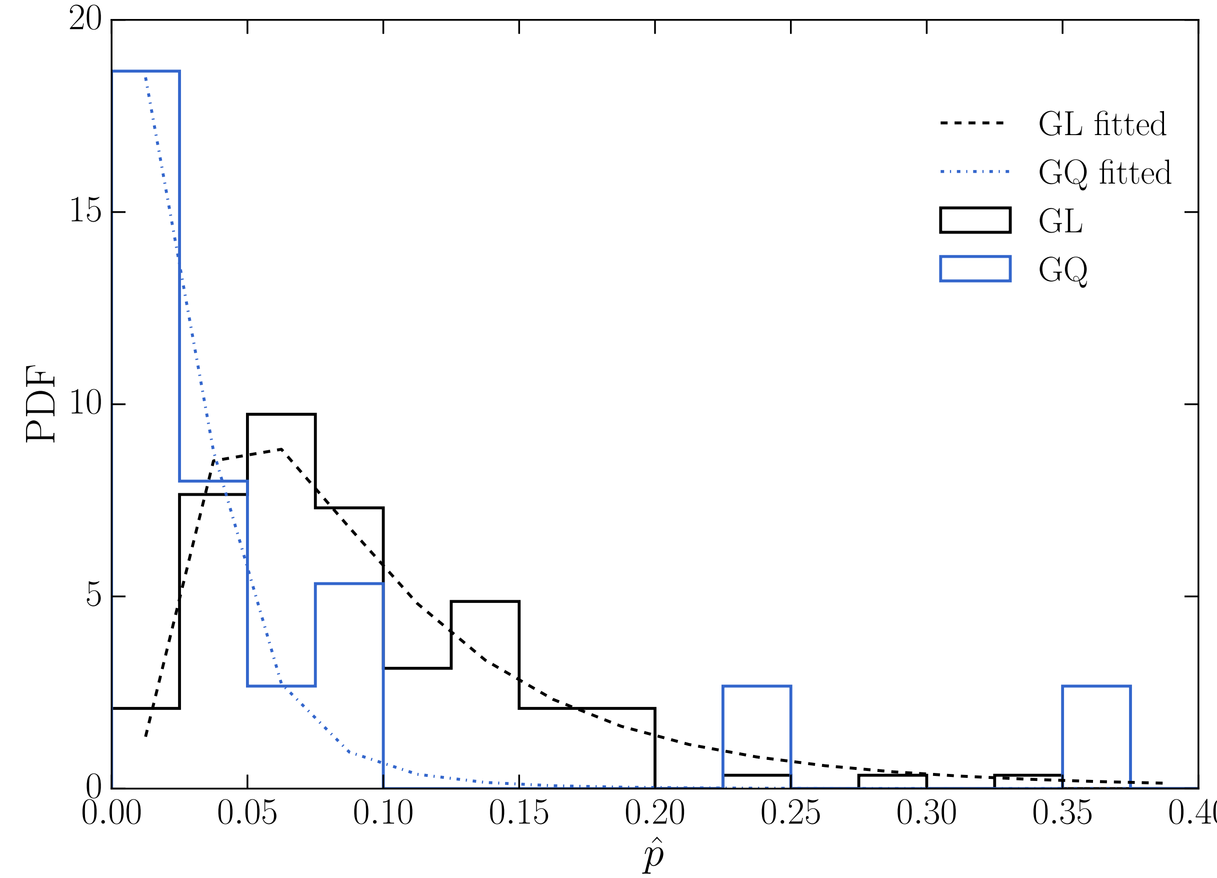


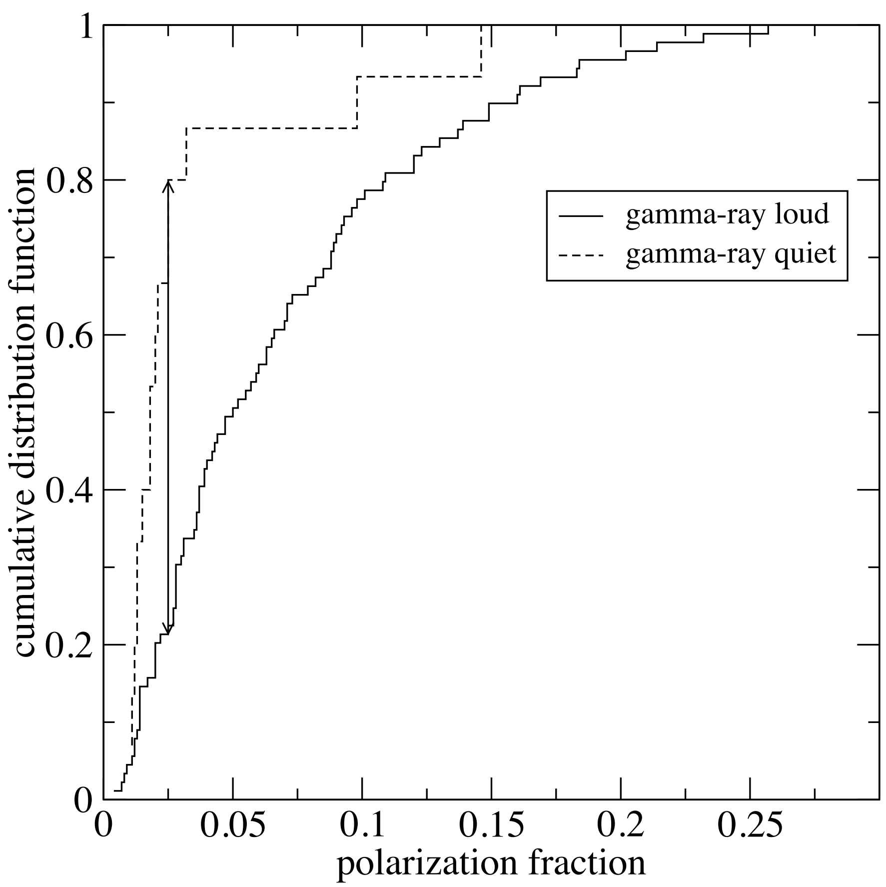
Caltech: M. Balokovic, A. Mahabal, T. J. Pearson, A. Readhead
Uni of Crete: D. Blinov, N. Kylafis, G. Panopoulou, I. Papadakis, I. Papamastorakis, V. Pavlidou, P. Reig, K. Tassis
MPIfR: E. Angelakis, I. Myserlis, J. A. Zensus
IUCAA: V. Joshi, S. Prabhubesai, A. Ramaprakash
Nicolaus Copernicus University: A. Kus - A. Marecki, E. Pazderski
Other: T. Hovatta, S. Kiehlmann, O. King



- ➡ p uncertainty: less than 0.01
- ➡ χ uncertainty: 1-2 deg
- ➡ R-mag uncertainty: ~0.02-0.04 mag







median (KS test p: 6.5×10^{-4})

- GL: 0.078
- GQ: 0.031

$$\mathrm{PDF} = \frac{1}{x\sigma\sqrt{2\pi}} e^{-\frac{(\ln x - \mu)^2}{2\sigma^2}}$$

- GL: 0.105 (var: 0.0068)
- GQ: 0.035 (var: 0.0011)

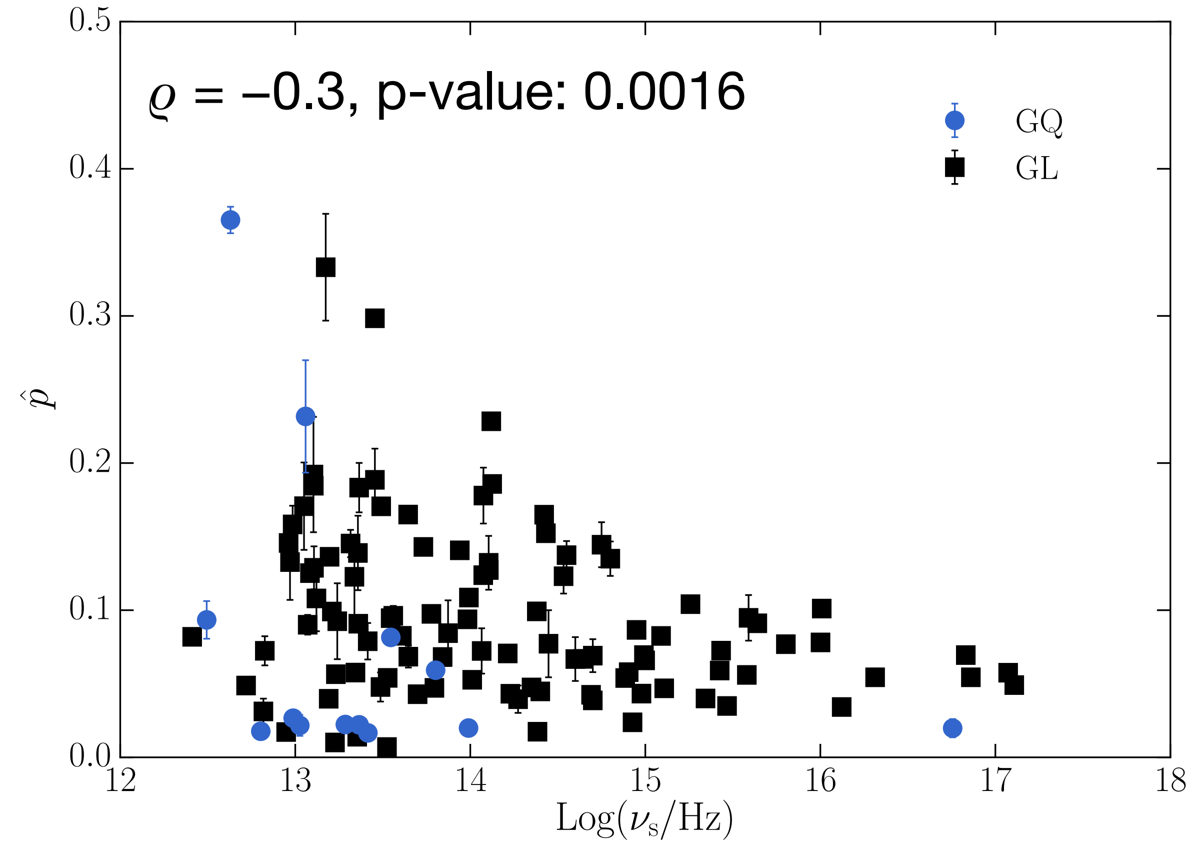
Pavlidou et al. 2014, MNRAS.442.1693P

Angelakis et al. in prep.

the polarization of GL and GQ:

Angelakis et al. in prep.

- ➡ GL more polarized than GQ:
  - **uniformity of the field?**
- ➡ function of the synchrotron peak

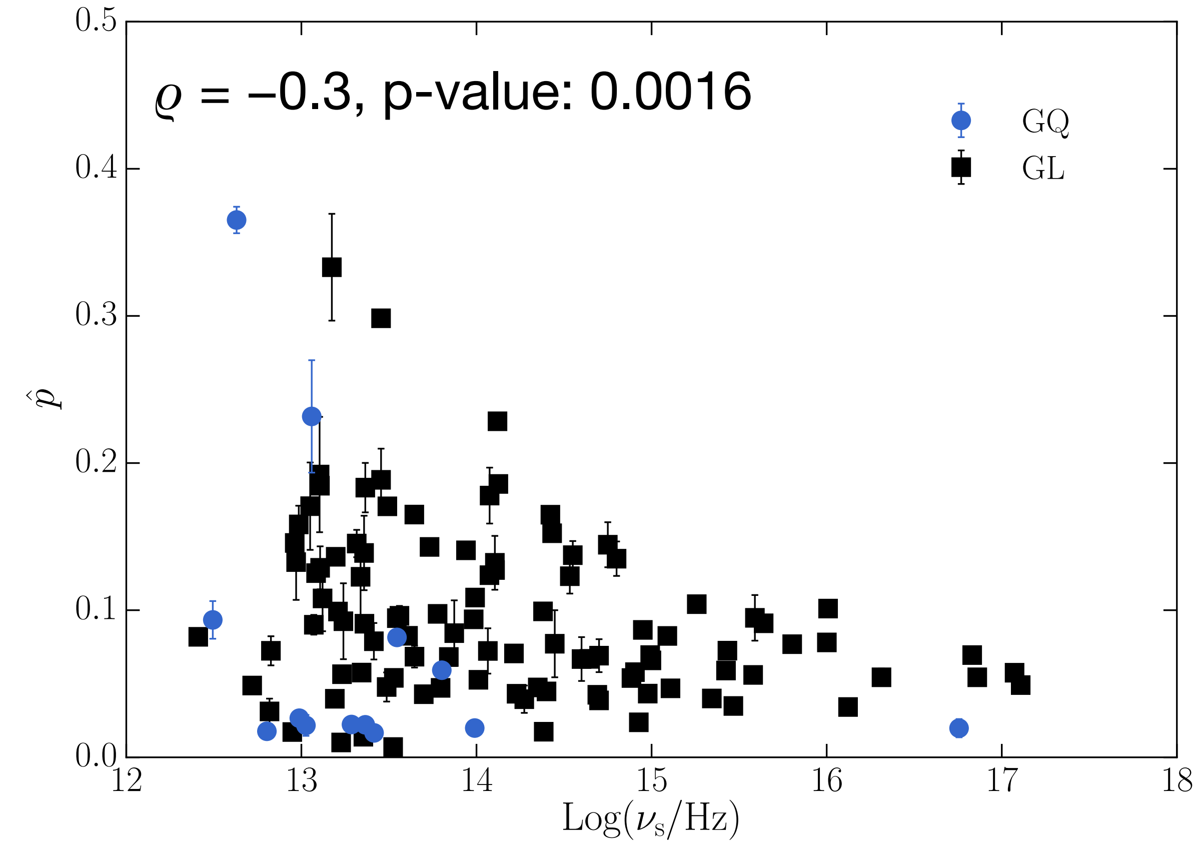


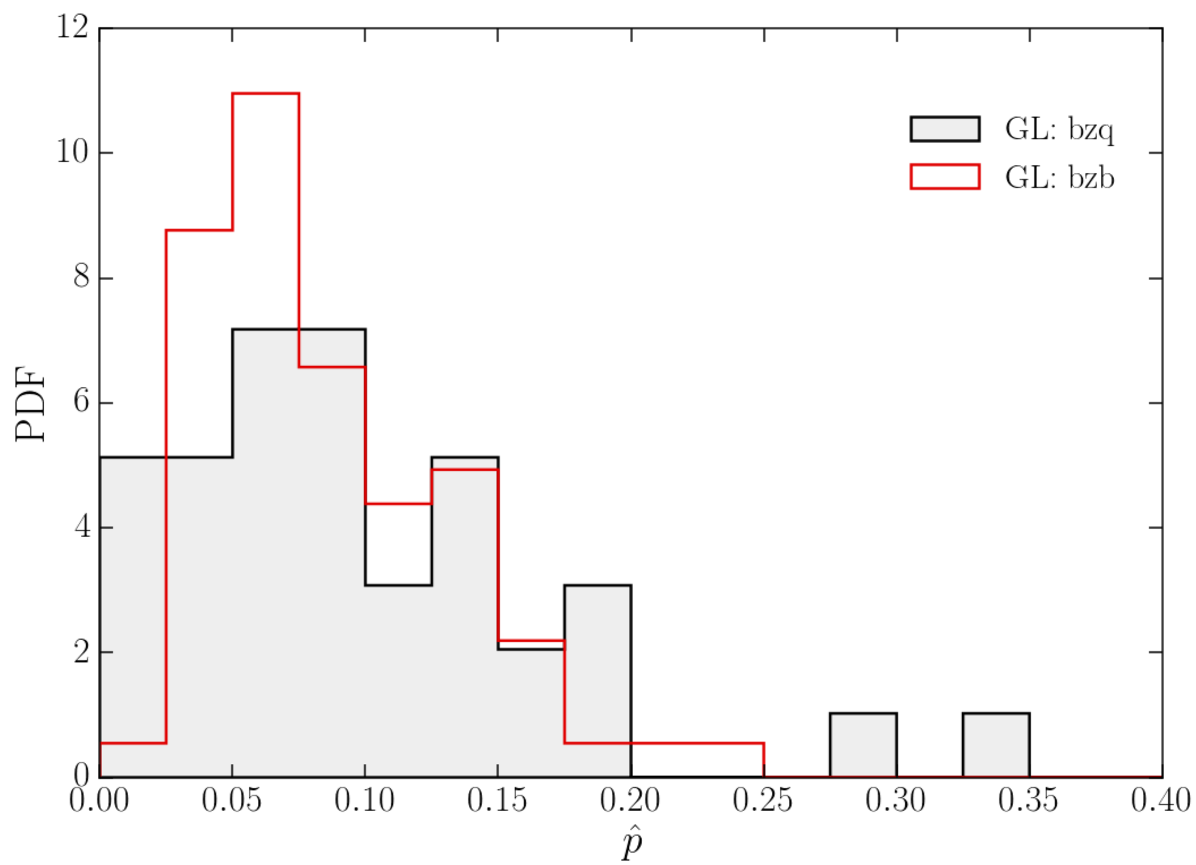
Angelakis et al. in prep.

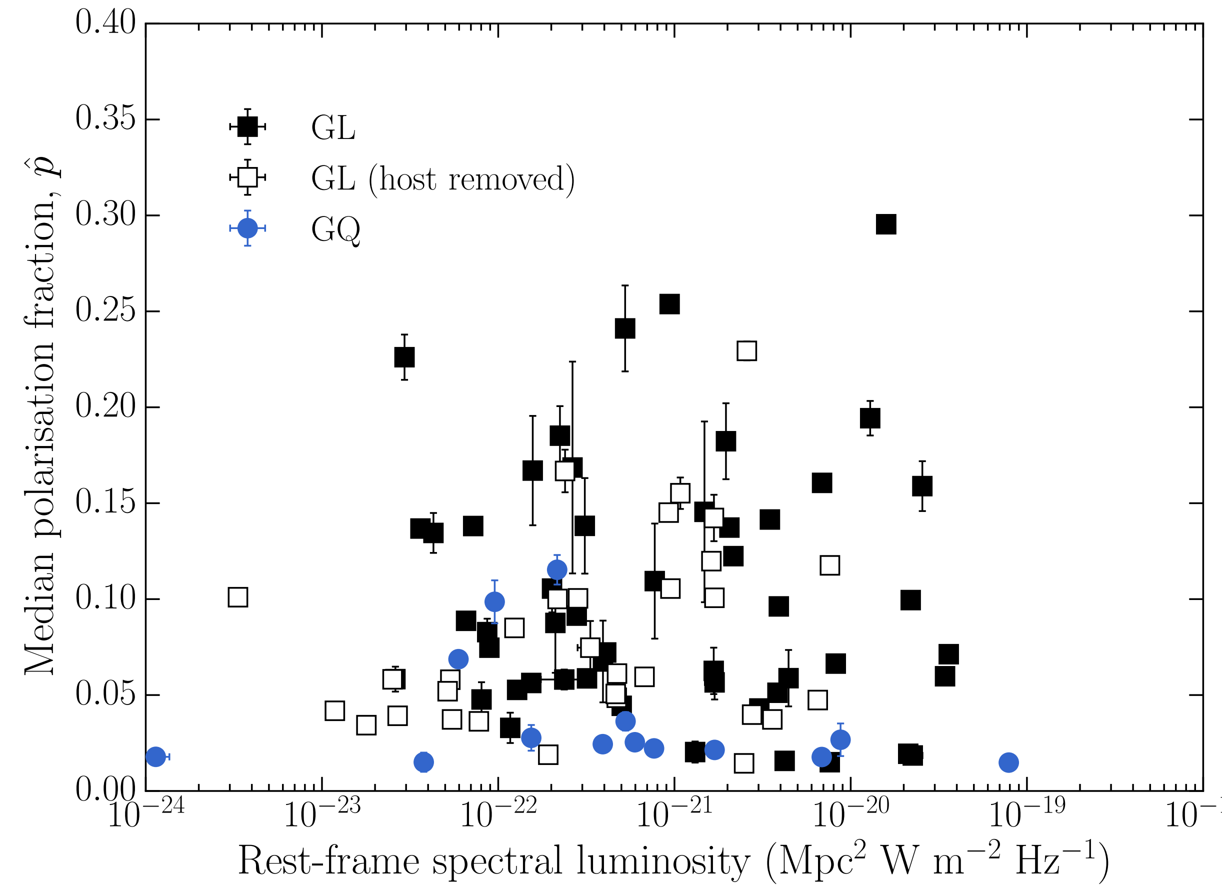
the polarization of GL and GQ:

Angelakis et al. in prep.

- GL more polarized than GQ:
  - **uniformity of the field?**
- function of the synchrotron peak
- independent of luminosity:
  - no association with source class







Angelakis et al. in prep.

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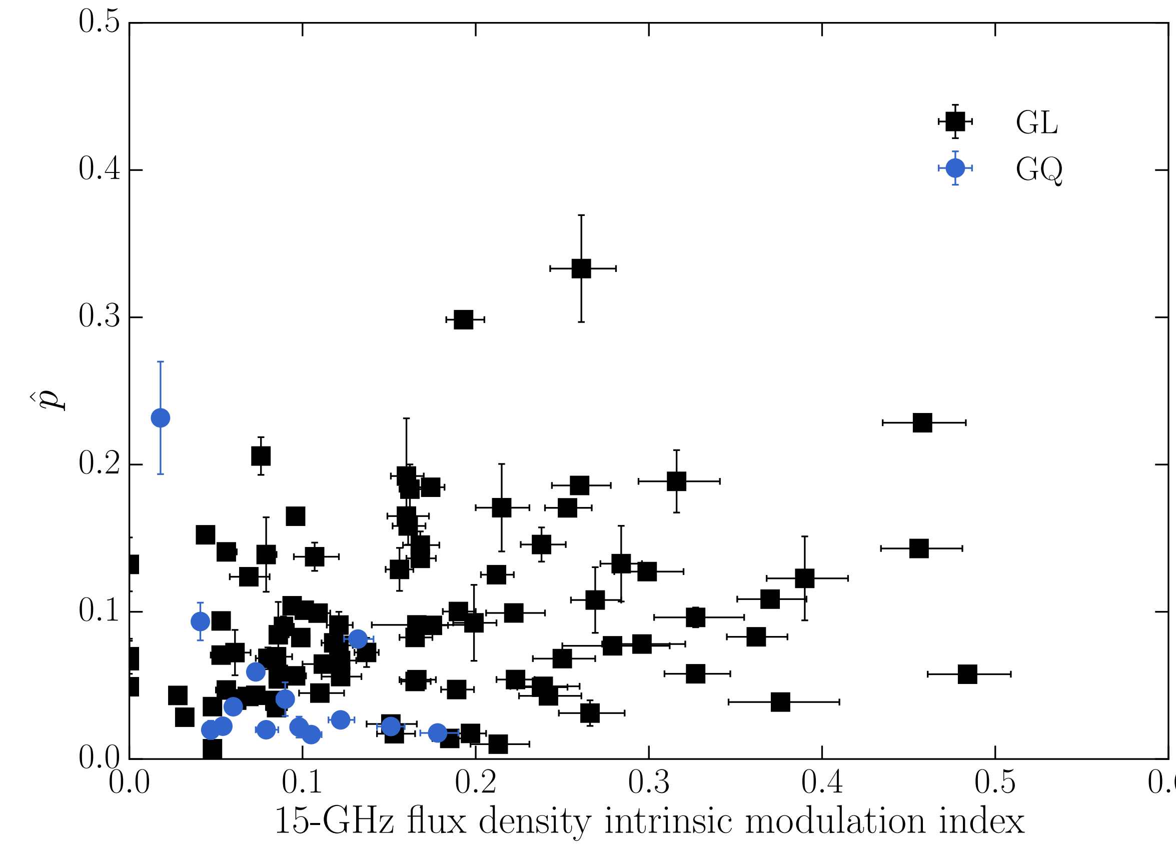
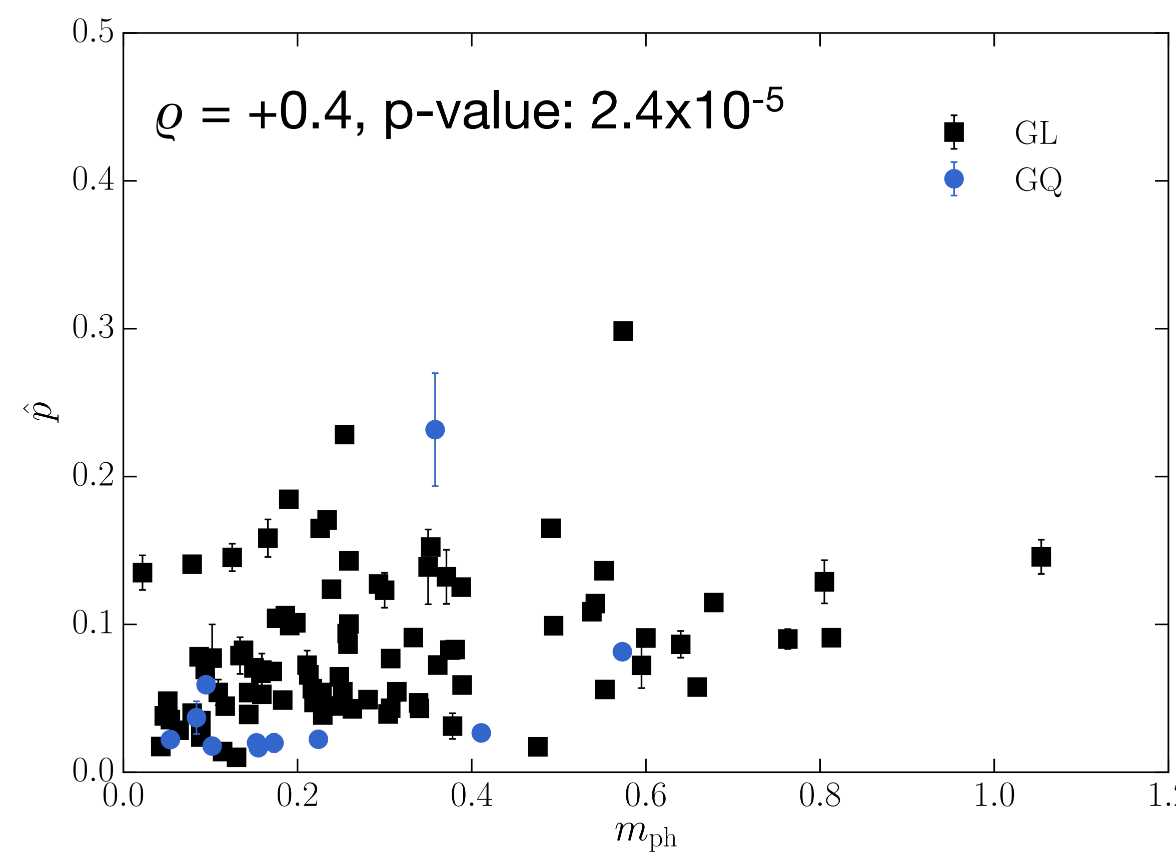
  - no association with source class
- independent of the radio variability amplitude
- correlated with the optical variability amplitude

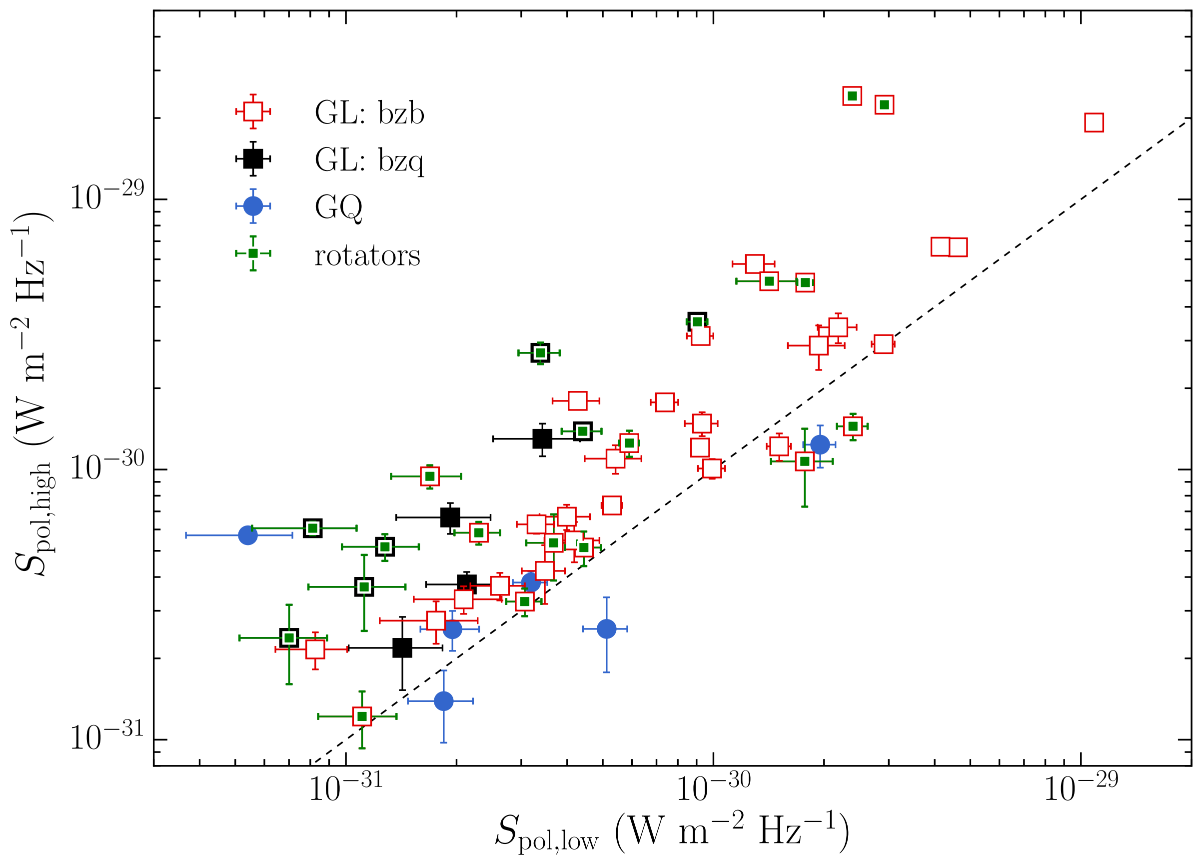




Angelakis et al. in prep.

the polarization of GL and GQ:
Angelakis et al. in prep.

- GL more polarized than GQ:
  - **uniformity of the field?**
- function of the synchrotron peak
- independent of luminosity:
  - no association with source class
- independent of the radio variability amplitude
- correlated with the optical variability amplitude
- **non-thermal events?**
- a mechanism that:
  - **moves the SED horizontally**
  - **increases the polarisation**

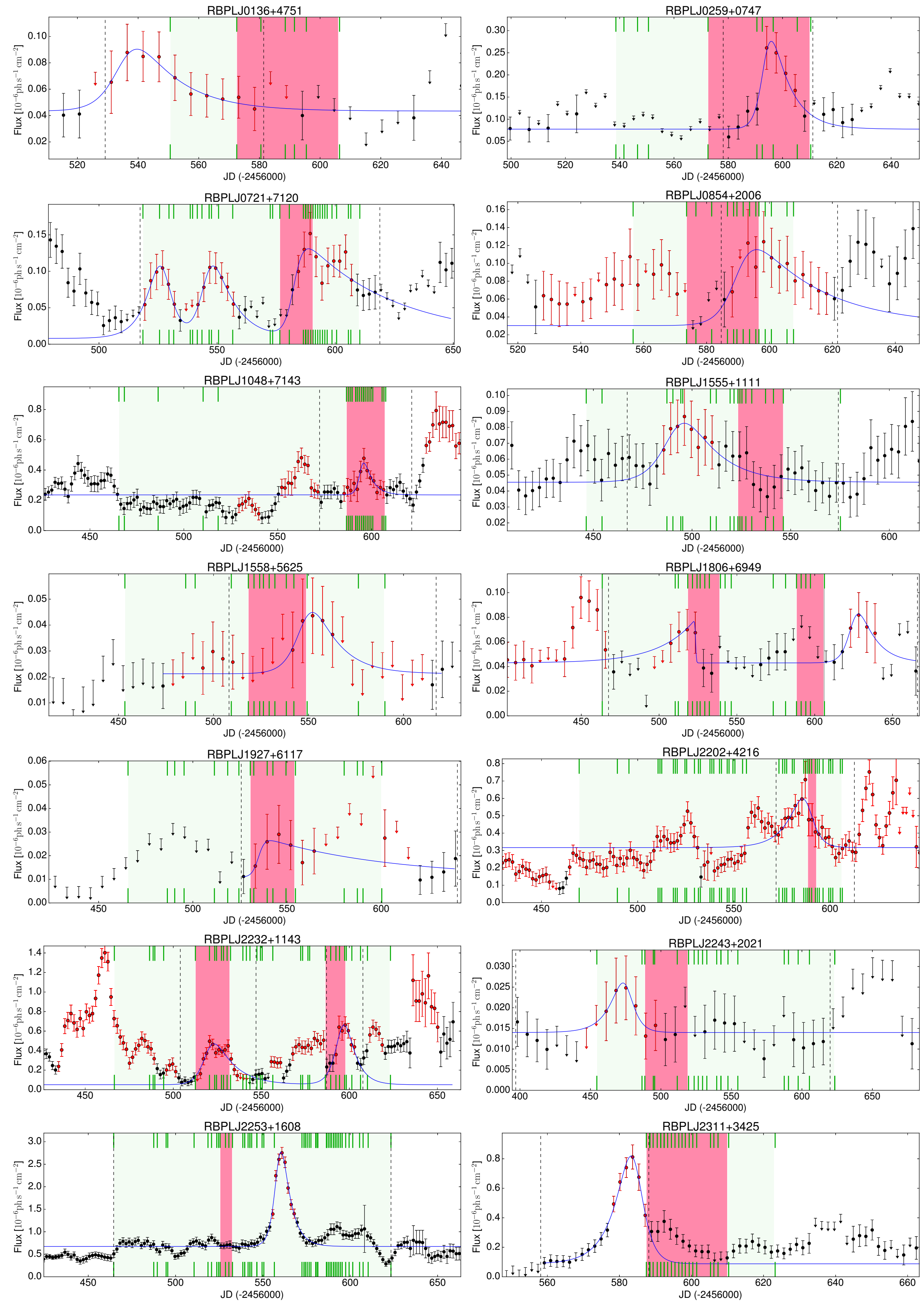


Angelakis et al. in prep.

EVPA rotations

Blinov et al. 2015, MNRAS.453.1669B; Blinov et al. in prep.

- ➡ detected 27 rotations:
  - ▸ 2013: 16 rotations in 13 blazars
    Blinov et al. 2015, MNRAS.453.1669B
  - ▸ 2014: 11 rotations in 10 blazars
    Blinov et al. in prep.

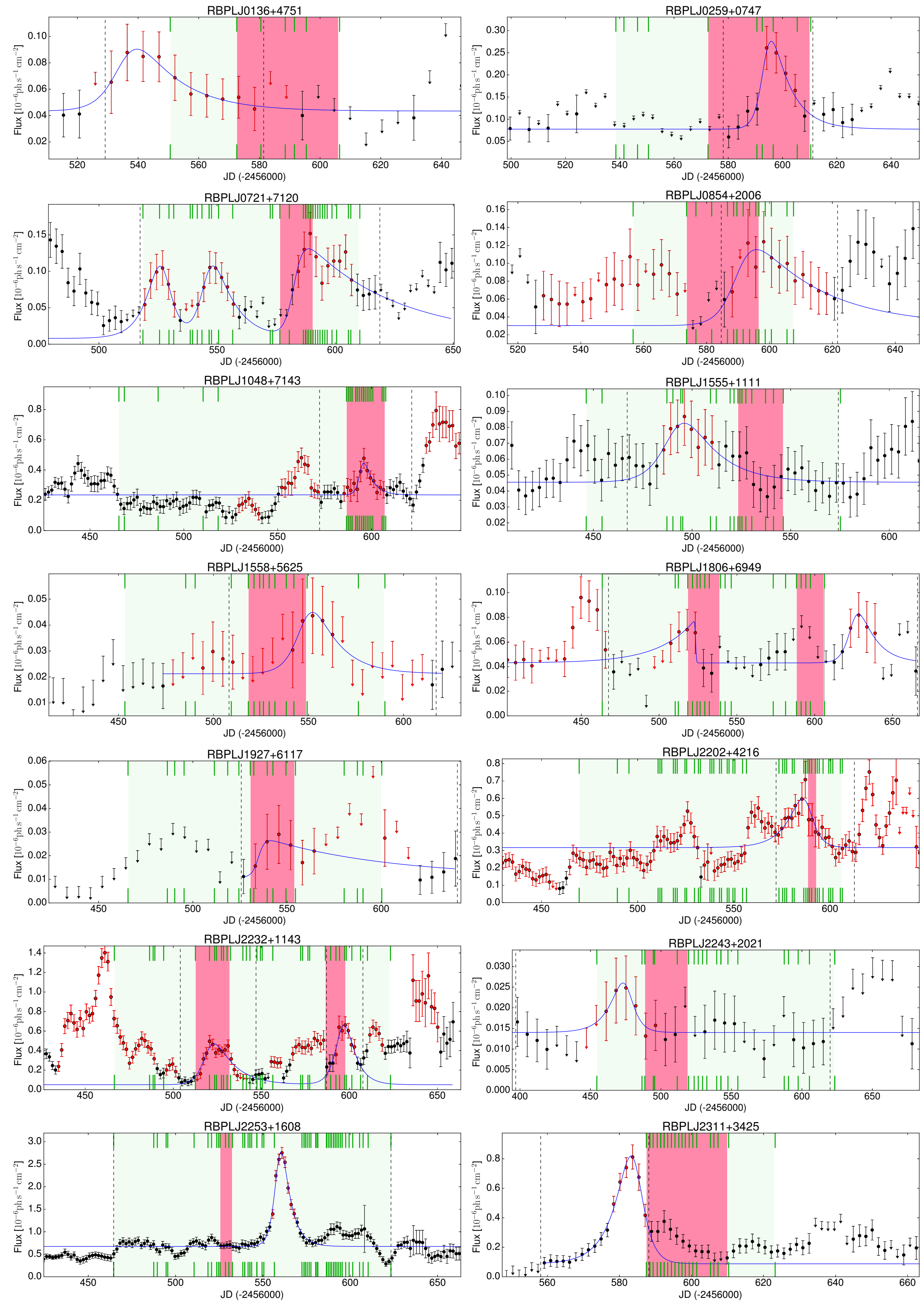


Blinov et al. 2015, MNRAS.453.1669B

EVPA rotations

Blinov et al. 2015, MNRAS.453.1669B; Blinov et al. in prep.

- detected 27 rotations:
  - 2013: 16 rotations in 13 blazars
    Blinov et al. 2015, MNRAS.453.1669B
  - 2014: 11 rotations in 10 blazars
    Blinov et al. in prep.
- all classes can “rotate” (HSP/LSP, FSRQs/BL Lacs, TeV and non-TeV)
  - there is some dependence on the synchrotron peak with LSP rotations more often
- both senses of rotation are allowed in the same source
  - the rate can vary a lot for the same source



Blinov et al. 2015, MNRAS.453.1669B

EVPA rotations

Blinov et al. 2015, MNRAS.453.1669B; Blinov et al. in prep.

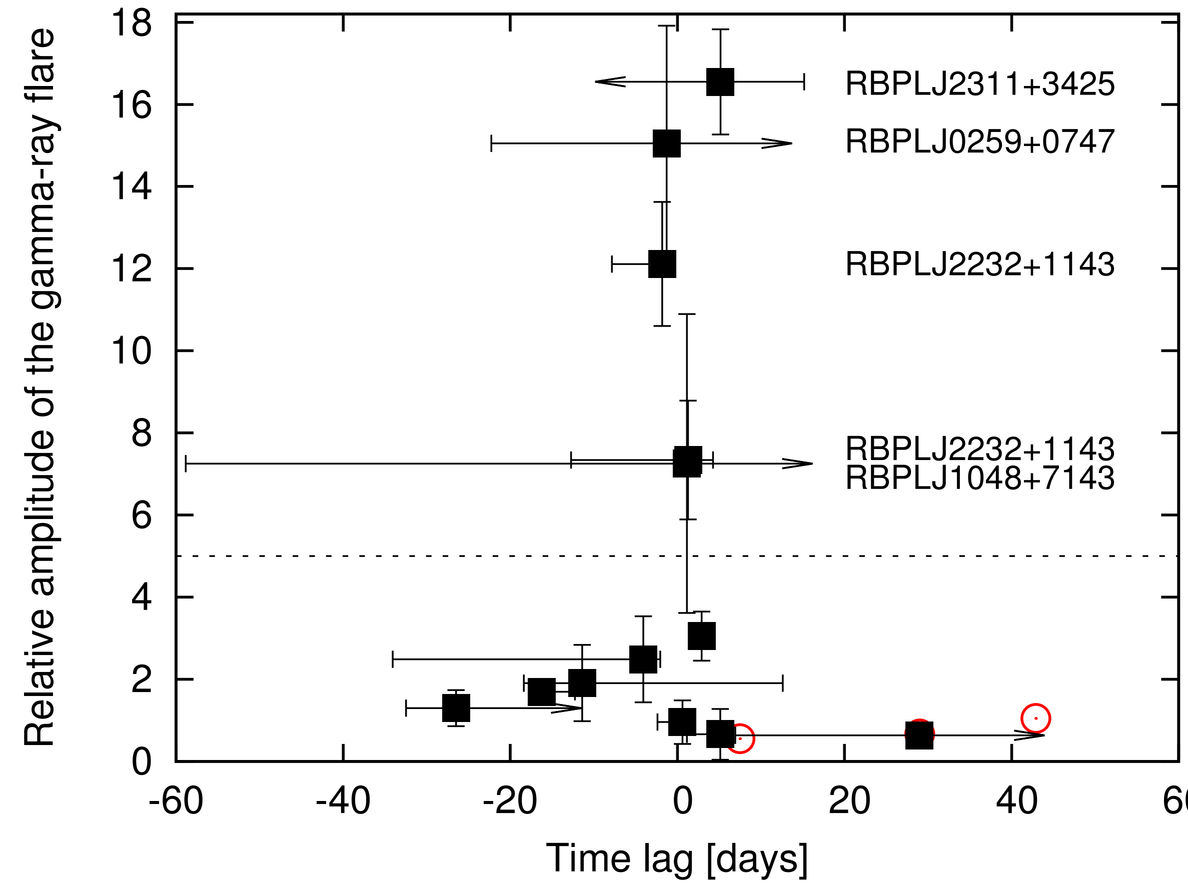
- all “rotators” are GL:
  - physical relation between γ-ray and optical polarization variability
- MC simulations: it is unlikely ($p \leq 1.5 \times 10^{-2}$), that all the rotations are due to a random walk process

Blinov et al. 2015, MNRAS.453.1669B

EVPA rotations

Blinov et al. 2015, MNRAS.453.1669B; Blinov et al. in prep.

- ➡ data suggest:
  - the highest amplitude γ-ray flares are associated with smaller-than-average time lags
- ➡ two physical mechanisms:
  - one results higher amplitude flares and EVPA rotations
  - the other may be RW processes producing smaller amplitude flares, not related with rotations



Blinov et al. 2015, MNRAS.453.1669B

summary:

- ➡ high cadence, high precision optical linear polarization monitoring
- ➡ GL sources significantly more polarised:
  - B-field uniformity
  - non-thermal variability dominance
- ➡ 27 rotations found in 2 seasons (16 before RoboPol)
  - all “rotators” are GL: physical connection with γ-ray activity
  - unlikely that all are due to a random walk
  - data suggest: the highest amplitude γ-ray flares are associated with smaller-than-average time lags

thank you

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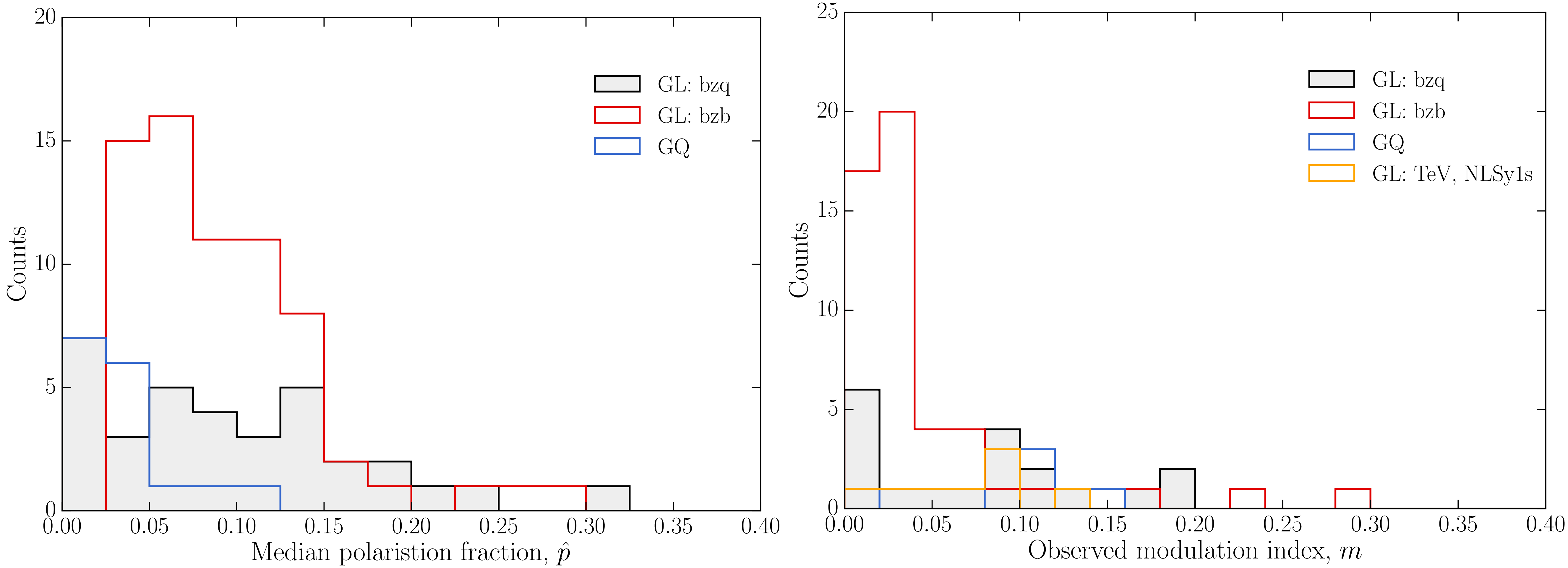

Angelakis et al. in prep.