SPRITE: The Stokes Polarimetric Radio Interferometer for Time-domain Experiments

Talvikki Hovatta on behalf of Anthony Readhead (Caltech)

SPRITE

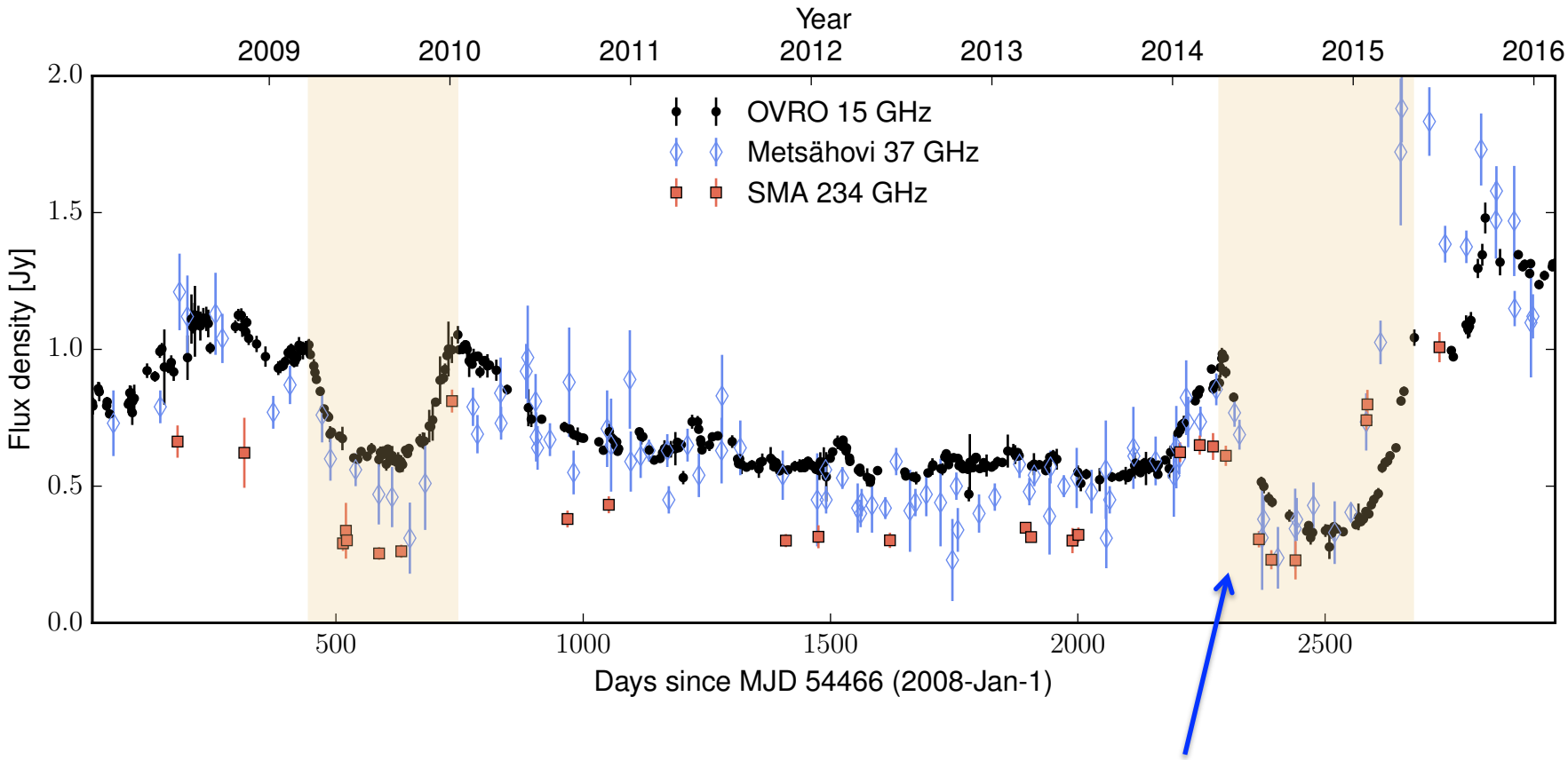
- Will use 5 of the 10m CARMA antennas, relocated to Owens Valley Radio Observatory in California
- Extension of the MARMOT blazar monitoring program that ran at CARMA
- Will observe different types of transient objects
- 1mm/3mm full polarization and wide bandwidth
- Currently seeking funding

Specifications

- Wide bandwidth (8 GHz)
- Full polarization (all Stokes)
- Expected sensitivity:
  - 2.7 mJy x $min^{1/2}$ at 3mm
  - 10.3 mJy x $min^{1/2}$ at 1mm (25% of time can do 1mm observations)
- Rapid response tim
  to triggers from
  the community!

SPRITE science: high-cadence monitoring in total intensity

Gravitational lensing event in PKS 1413+135 revealed by high-frequency data

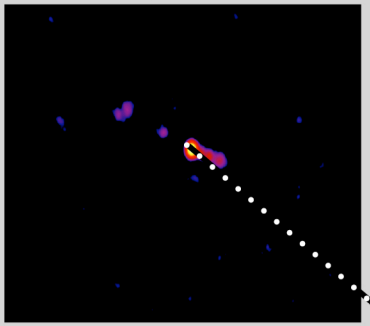


Vedantham et al. 2017a, ApJ, ArXiv: 1702.06582
Vedantham et al. 2017b, ApJ, ArXiv: 1702.05519

Achromatic events strongly favor gravitational lensing

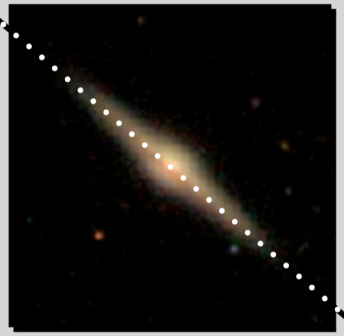
SPRITE science: high-cadence monitoring in total intensity

J1415+1320 (PKS1413+135)



radio source at
z~0.5

PKS1413+135 is an odd BL Lac-type object associated with a spiral galaxy

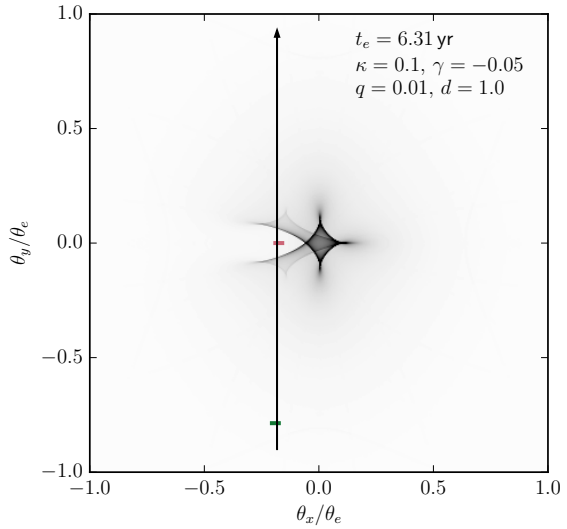


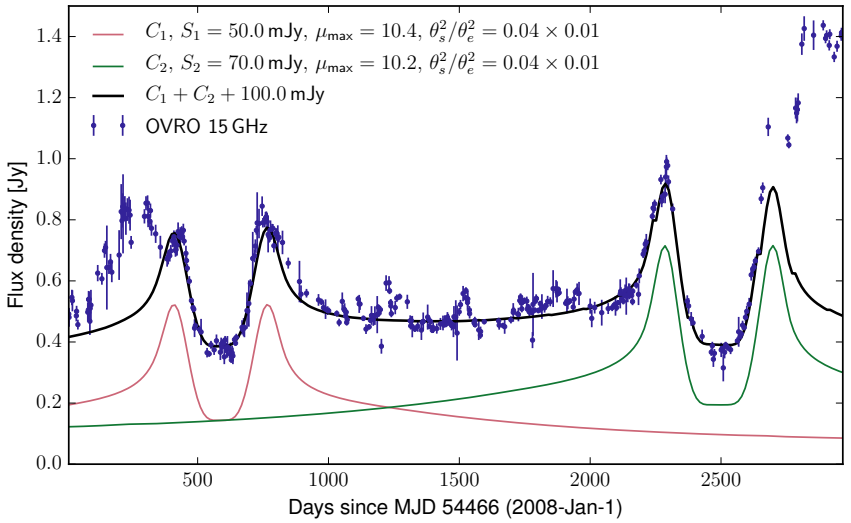
edge-on Sa
spiral galaxy
at z = 0.247

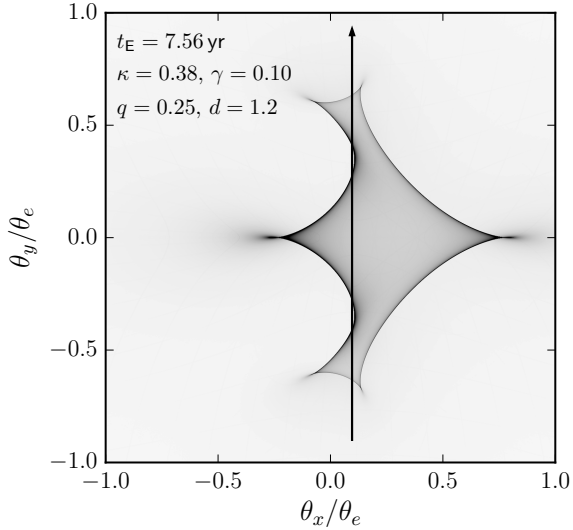
We suggest the radio source is behind the spiral galaxy (see also Stocke et al. 1992, Perlman et al. 2002)

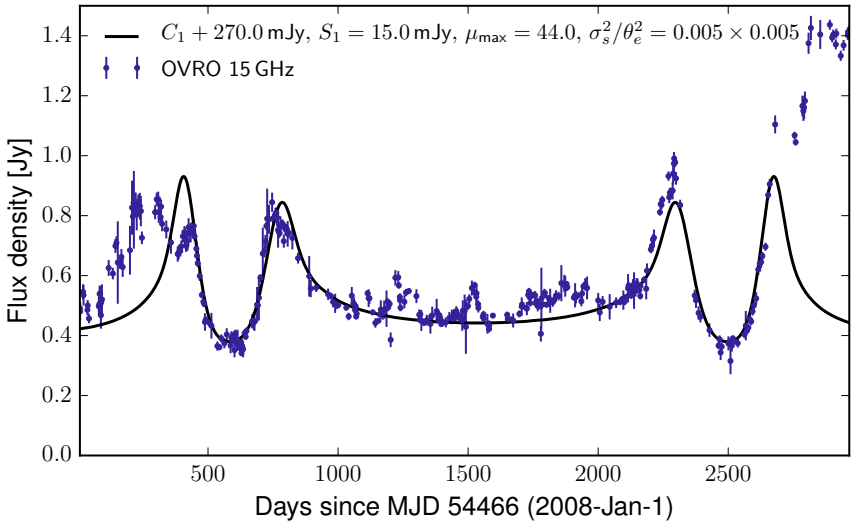
OVRO
40 m Telescope

Light curve of PKS1413+135 can be modeled with a simple binary lens model

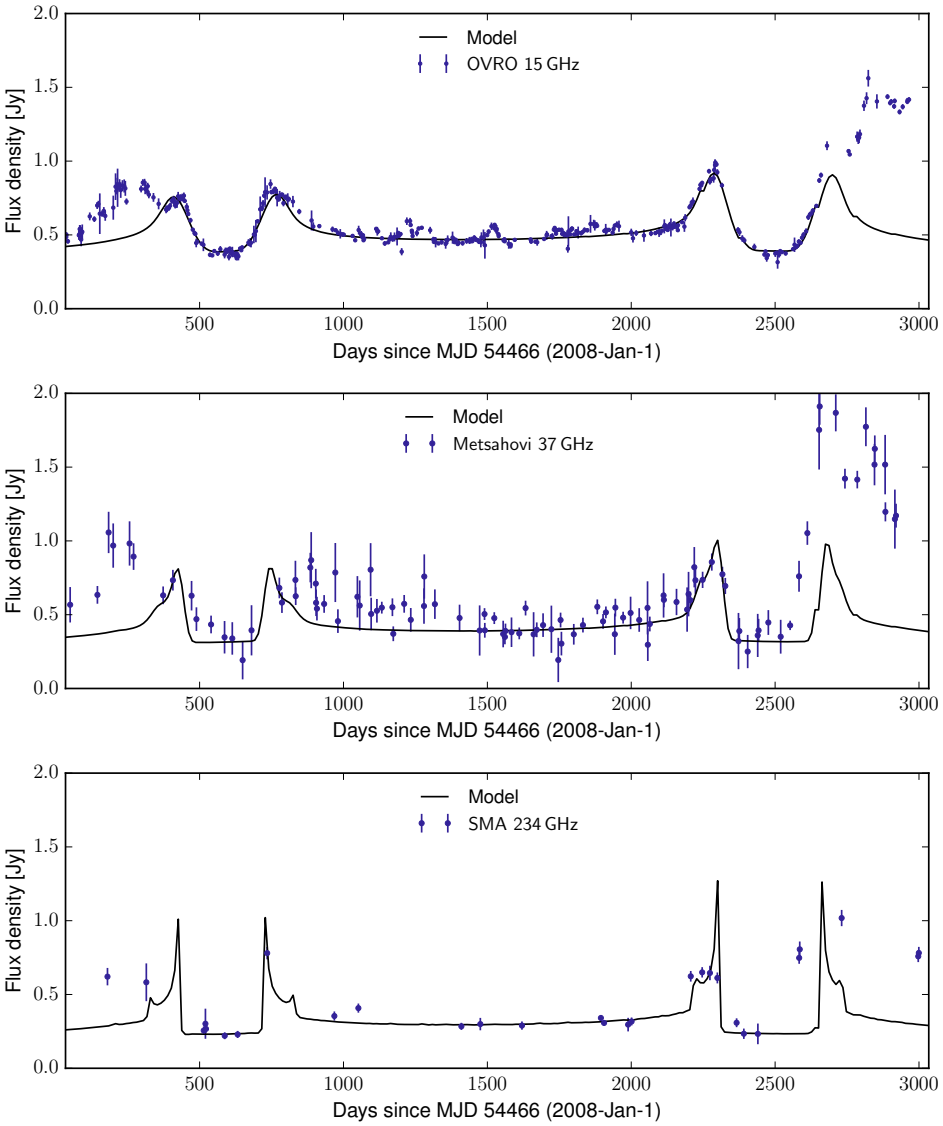




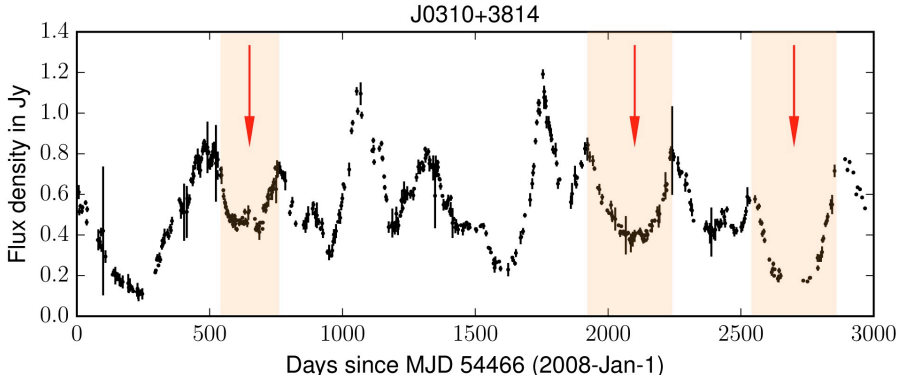


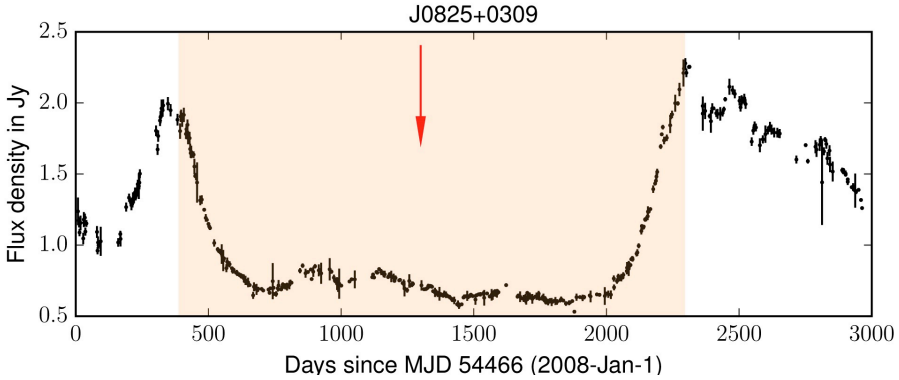


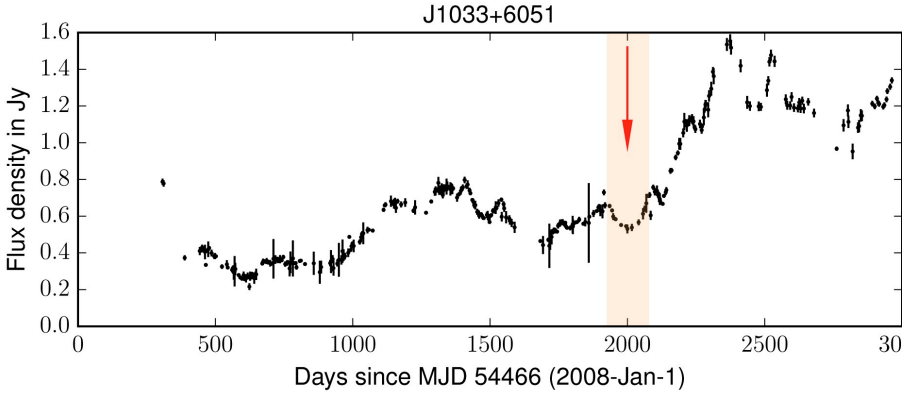
Model predicts mm-band behavior well

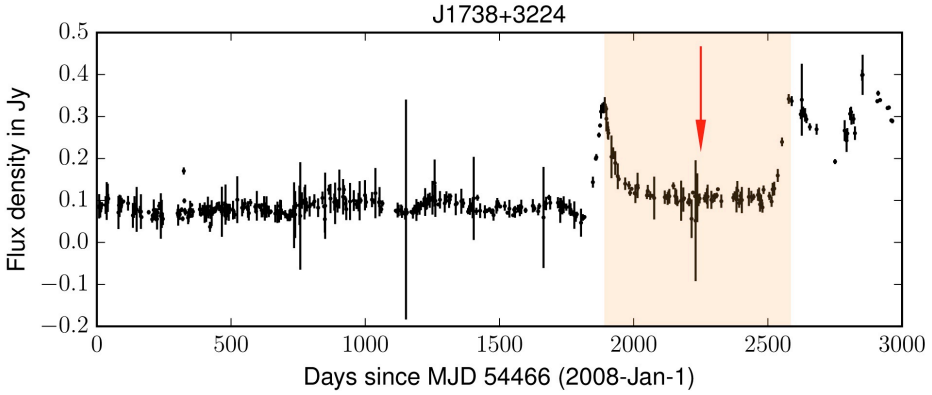


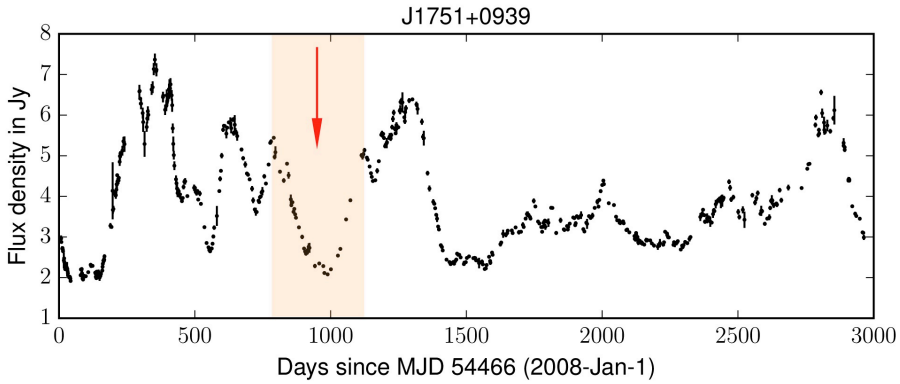
SPRITE science: Monitoring of other lensed sources at mm-bands

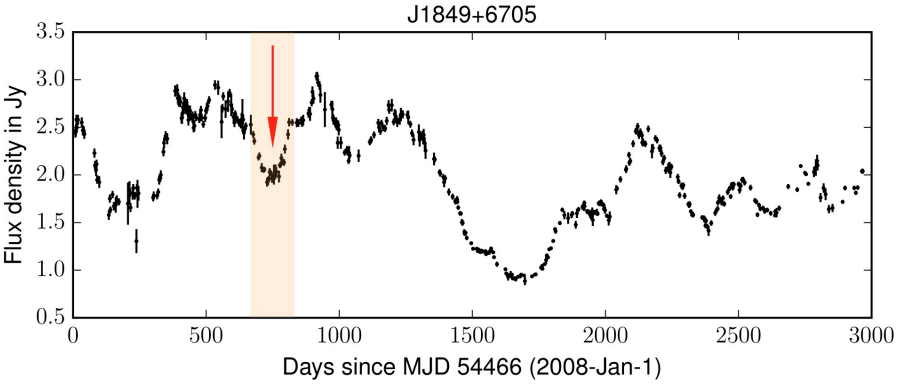






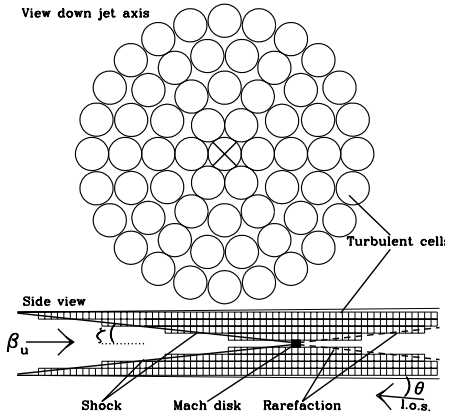


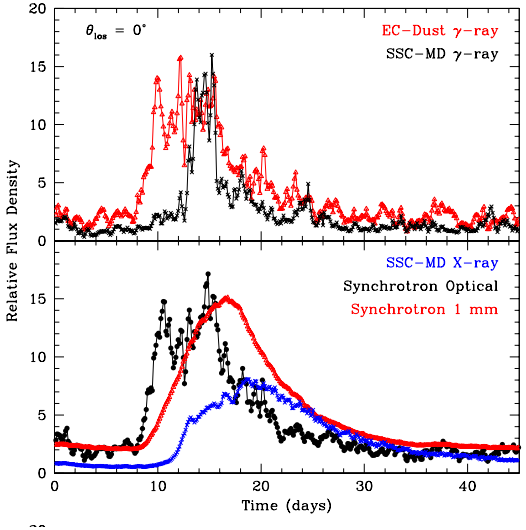


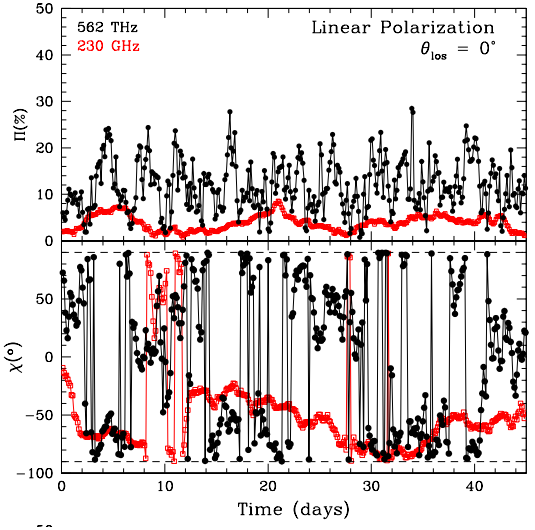


SPRITE science: high-cadence monitoring in Linear polarization

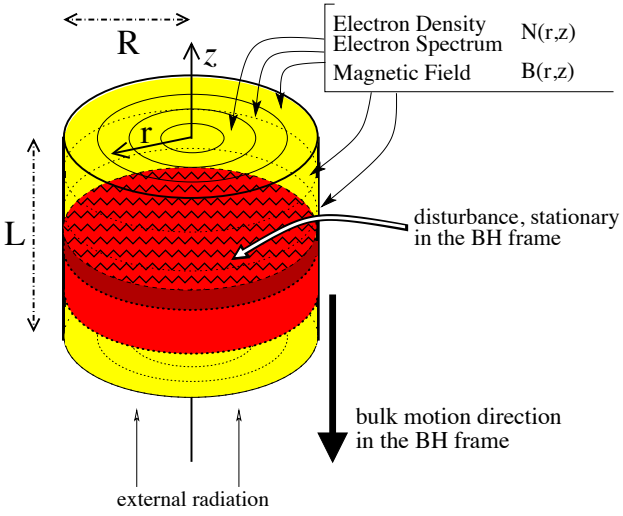
TEMZ model by Marscher 2014

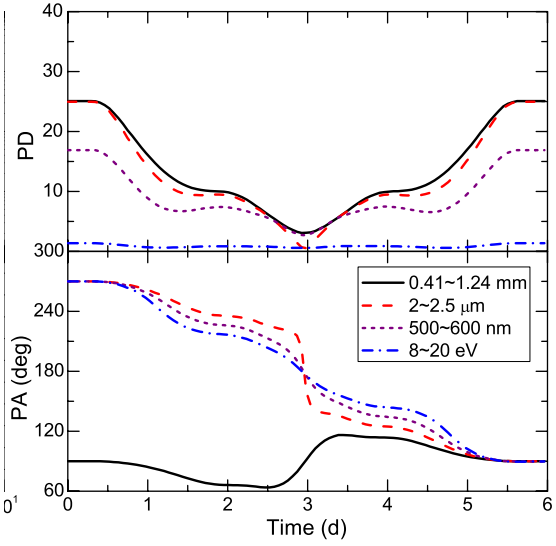


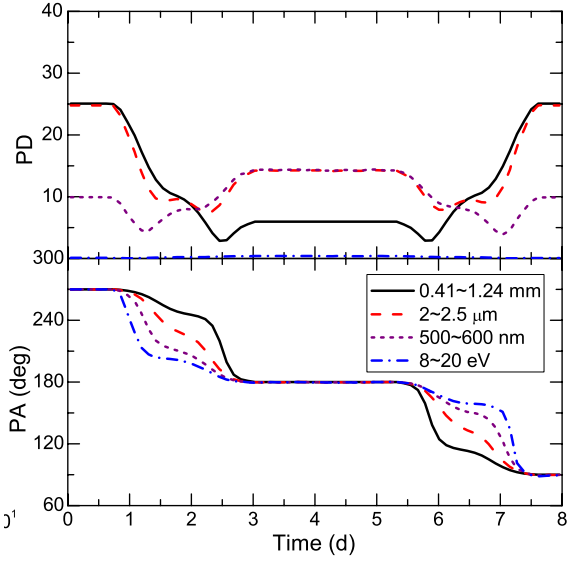




Shock in a helical field model by Zhang et al. 2014

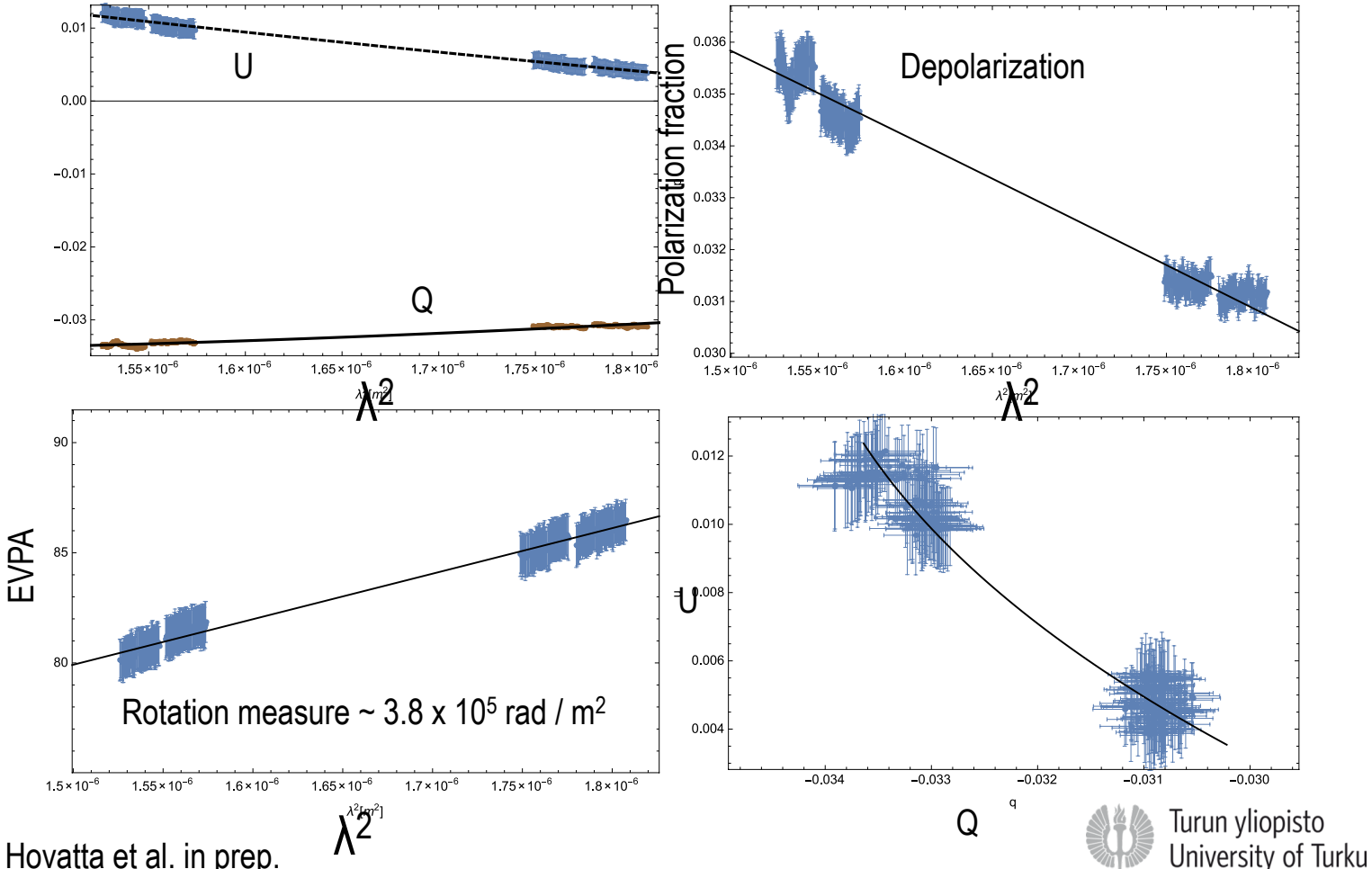






SPRITE science: Spectropolarimetry

ALMA observations reveal a large RM at 1mm



Hovatta et al. in prep.

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SPRITE science: Circular polarization

- High CP at mm-bands seen by POLAMI program (Ivan Agudo's talk yesterday)
- Wide bandwidth may allow us to distinguish between intrinsic circular polarization and Faraday conversion
- SED modeling typically require $\gamma_{min} \sim 1000$ while cm-band CP modeling finds $\gamma_{min} < 100$
- 3mm / 1mm emission optically thin

  -> May give us the low- energy cutoff of the electron population at the jet base

Expected Spectrum For Optically Thin Emission

- Intrinsic

$$m_c \propto \upsilon^{-0.5}$$

- Conversion

$$m_c \propto \upsilon^{-3}$$

Or Steeper…

Dan Homan's talk yesterday

Summary

- SPRITE will provide high-cadence full polarization monitoring of transient objects
- At least 3mm and 1mm
- Blazar-related science cases include monitoring of lensing candidates, linear polarization time series and spectra, circular polarization
  - Fast response times to GRB triggers
  - Microquasar monitoring
  - Extra baseline for EHT?