Drift Scan Observations

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Observational & Technical Training HartRAO

National Research Foundation

SARAO

South African Radio Astronomy Observatory

Detecting Radio Emission from Space

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- Simplest way to measure the intensity of a **compact source** in the sky, i.e. one that has an angular size much smaller than the beam, is to use an observing method called a **drift scan**.

- The output of the radiometer will be the **convolution of the antenna beam pattern** with the **brightness distribution of the source.**

- If the source is compact, the output from the radiometer during the scan is effectively an **east-west cross-section of the beam** of the telescope.

- The length of the drift scan depends on 1/cosine(source declination). So a drift scan across an object at 60 degrees south will take twice as long as one at 0 declination, and there will be twice as many points across the half-power beamwidth.

Detecting Radio Emission from Space

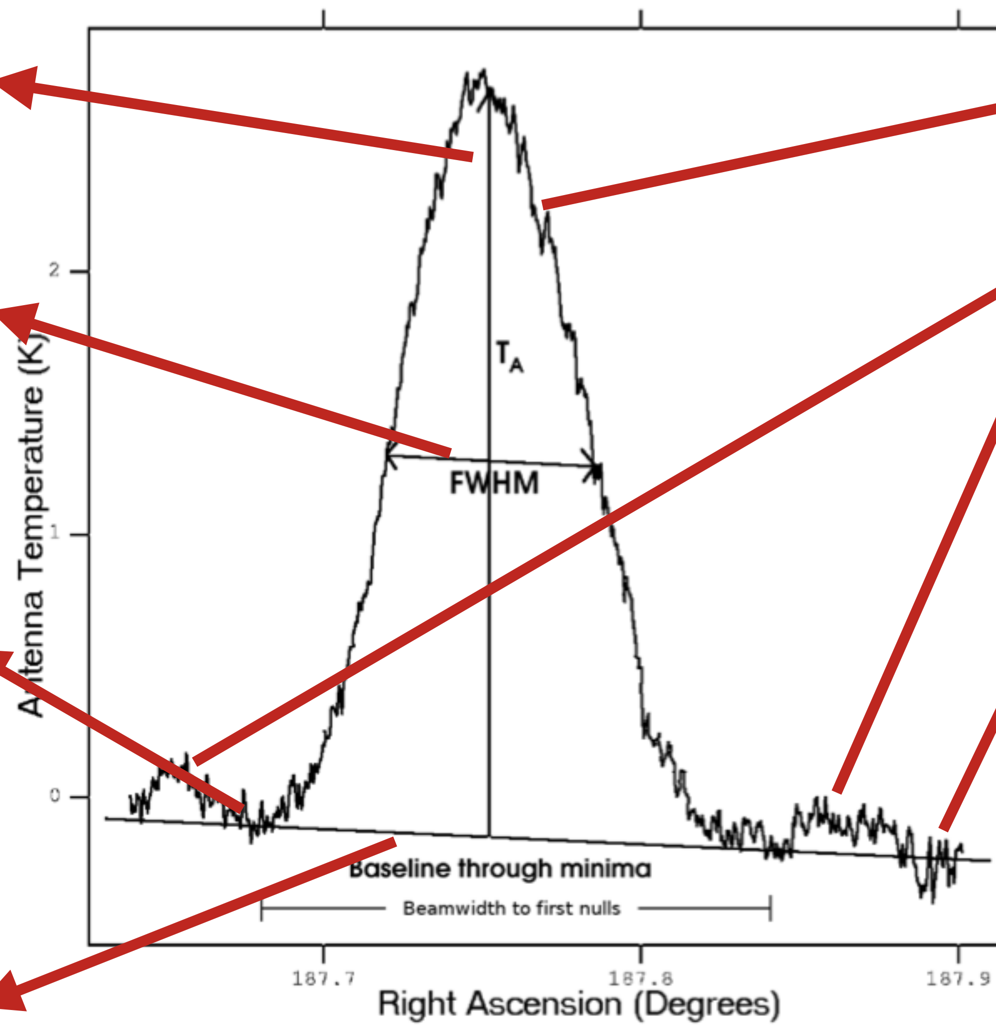
An example of a **drift** scan

We measure the height above the baseline at the centre of the beam to get the **antenna temperature.**

We can also measure the **FWHM** if it is an unresolved source.

Looking at the **minima** across the scan we can see a **slow drift** in the signal level. This could be due to changing atmospheric conditions or a slow change in the gain of the receiver.

We need to establish the **slope between the first nulls** by drawing a line between them.



The passage of the **main beam** across the radio source is in the centre

The first **side lobes** are seen weakly on each side.

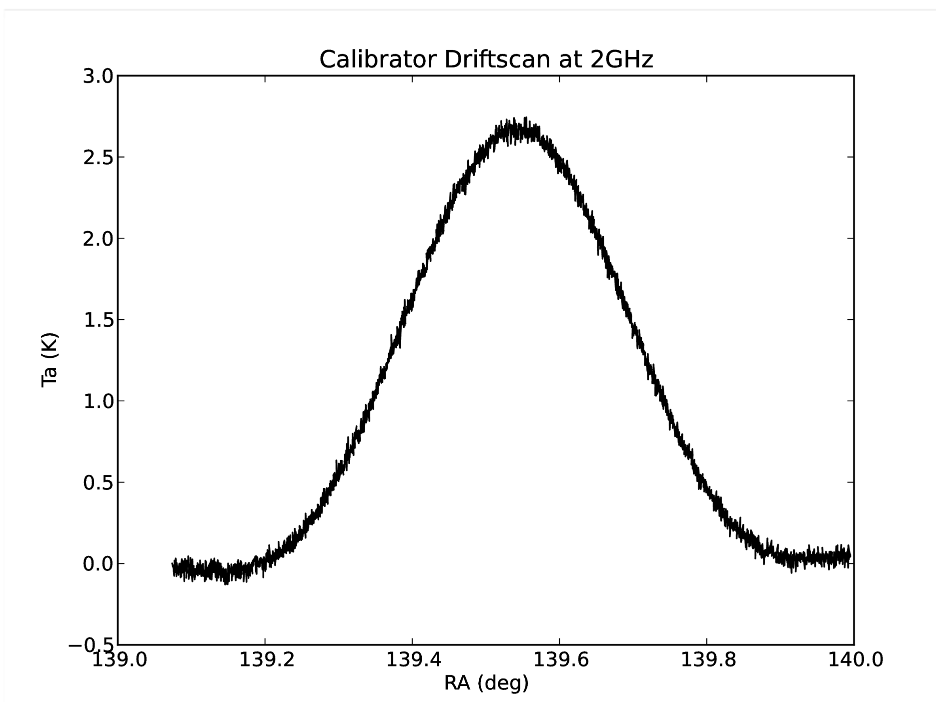
The **noise** is clearly visible.

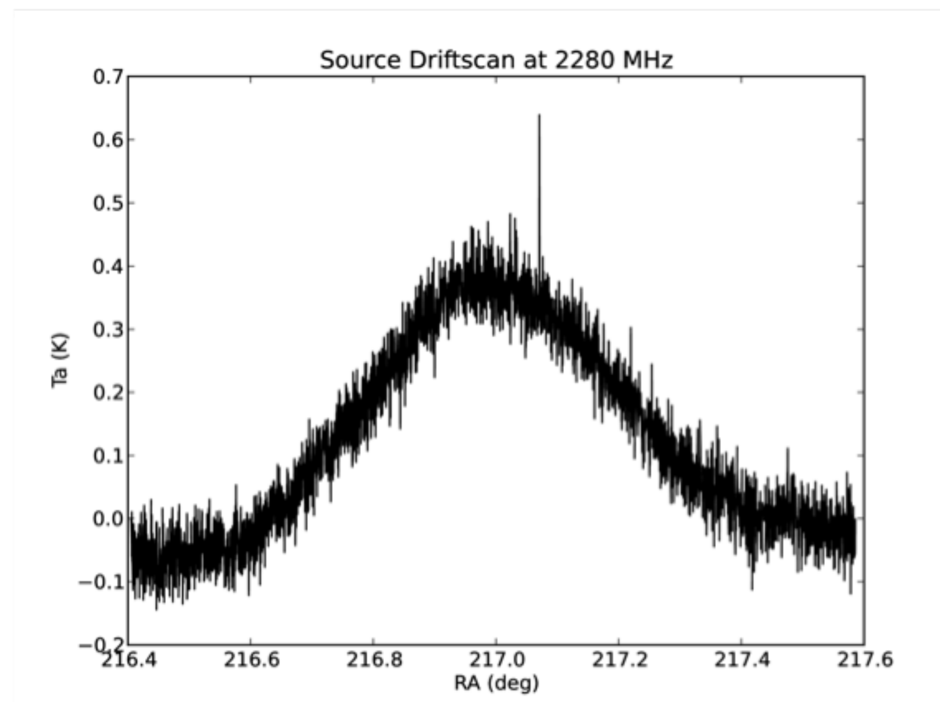
If the source is a calibrator, the *PSS* in this polarisation is obtained from the flux density S at the observing frequency (Ott et al. 1994).

Then we can find the flux density of unknown sources from their antenna temperature.

Monitoring of Active Galactic Nuclei

HartRAO 26 m telescope, drift scans => raw data





Calibrator: Hydra A
Image Credit: Pfesesani Nemanashi, Mike Gaylard

Source: J1427-4206 / PKS 1424-418Image Credit: Pfesesani Nemanashi, Mike Gaylard

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HartRAO 26 m telescope, drift scans => raw data

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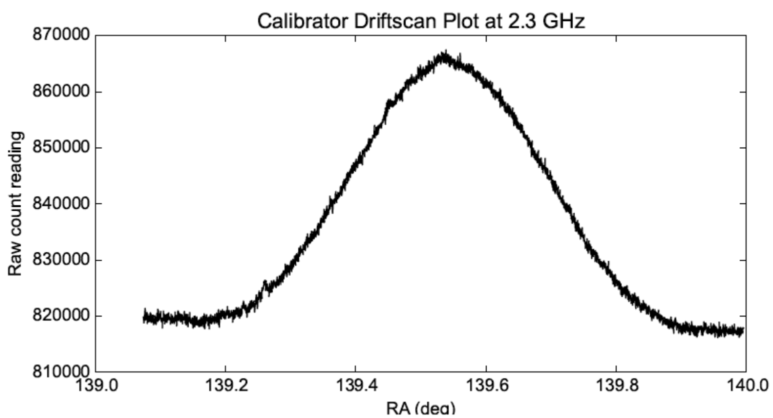
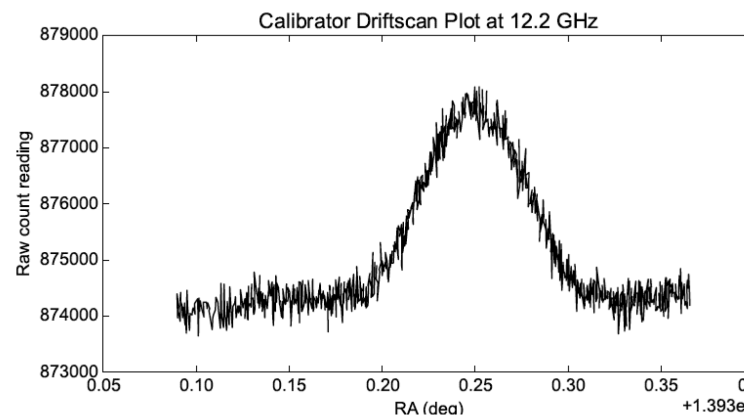
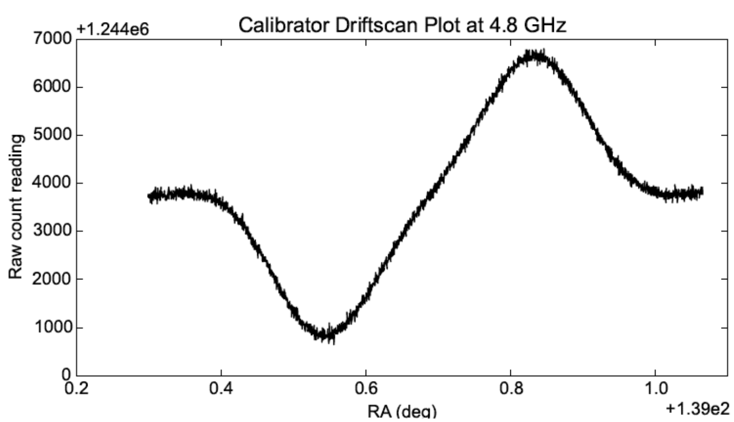


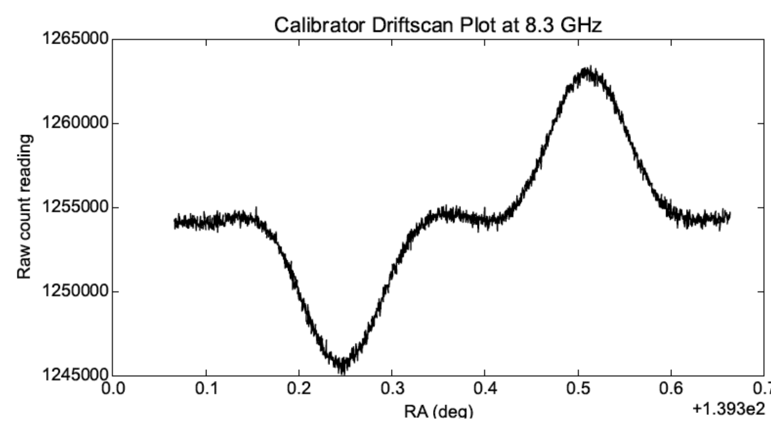
(a) Drift scan pattern output at 2.3 GHz.



(b) Drift scan pattern output at 12.2 GHz.



(c) Drift scan pattern output at 4.8 GHz.



(d) Drift scan pattern output at 8.3 GHz.

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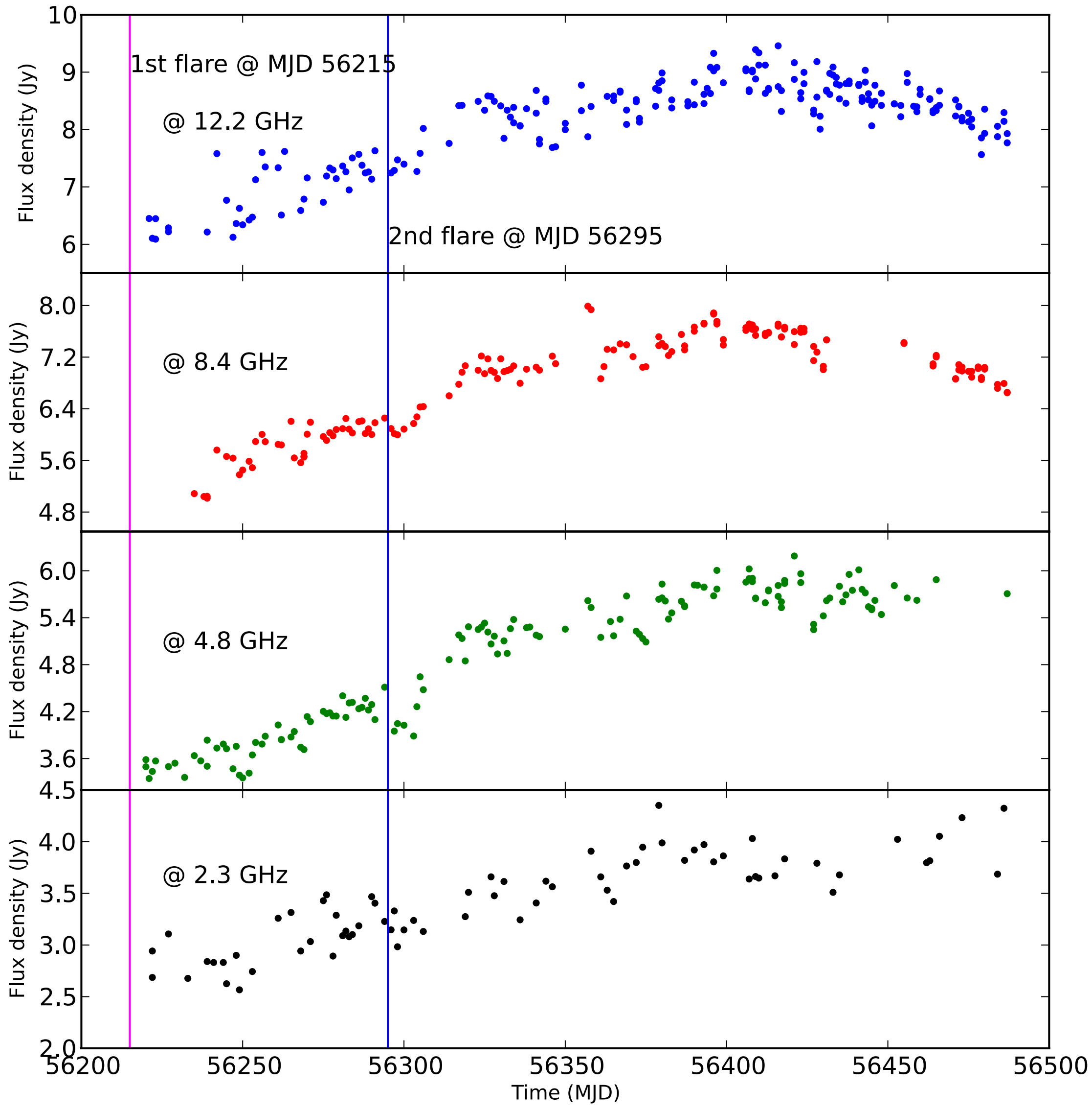
Monitoring of J1427-4206 - HartRAO 26 m



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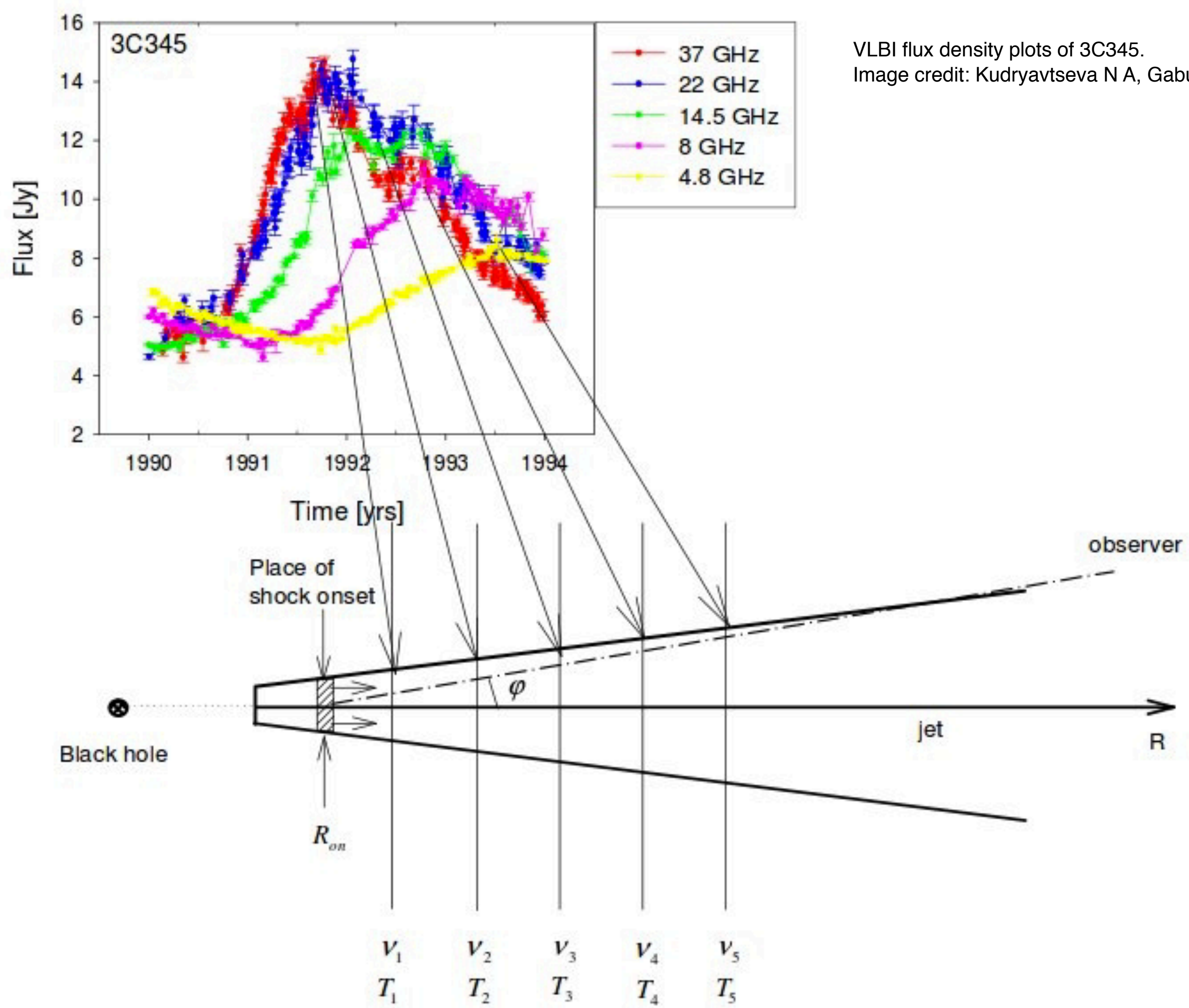
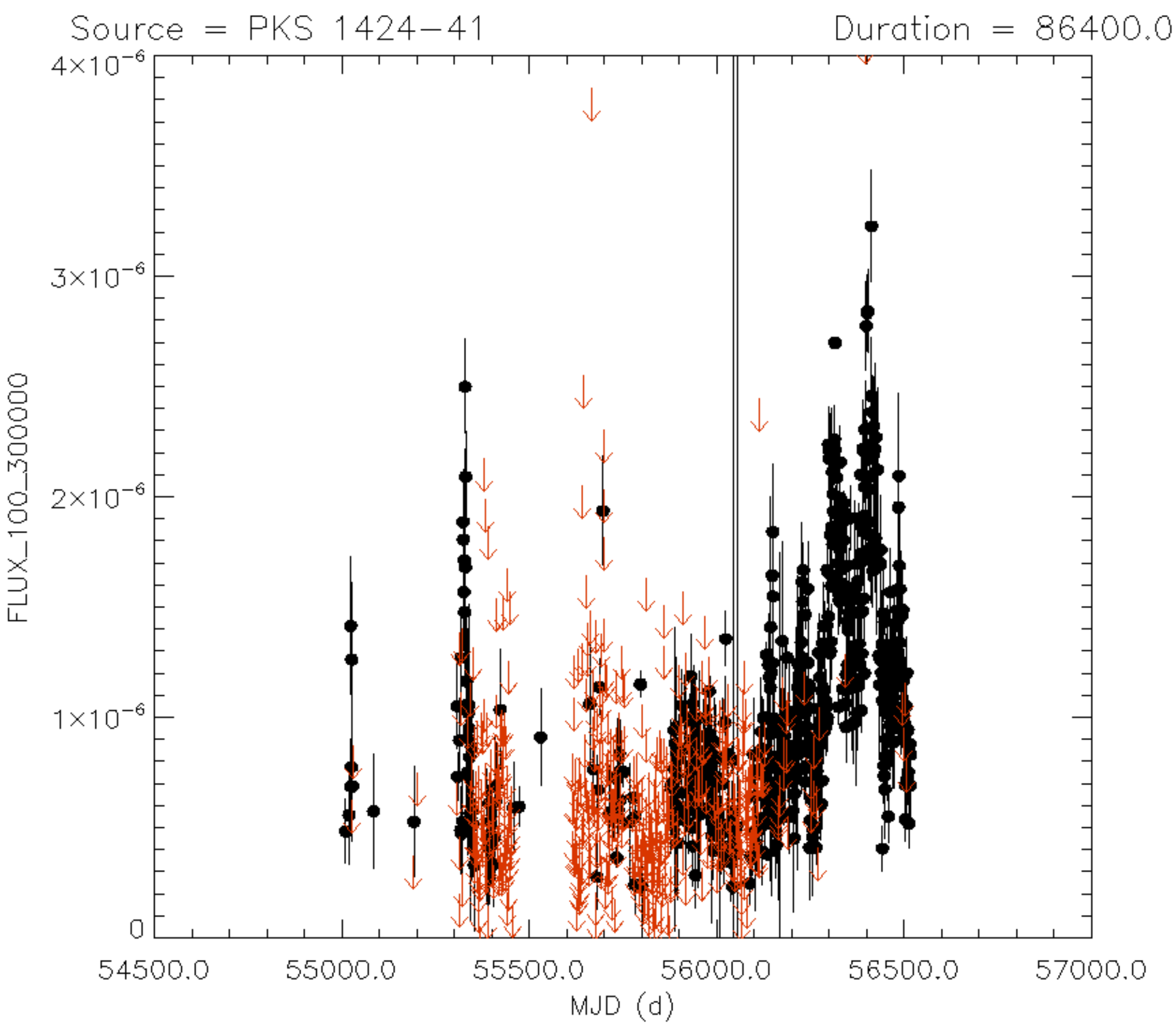


VLBI flux density plots of 3C345.
Image credit: Kudryavtseva N A, Gabudza D C, Aller M F and Aller H D, 2011

Monitoring of Active Galactic Nuclei

Fermi Gamma-ray data



Data Reduction

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3C218/Hydra A

J2000 coordinates RA:09h18m05.67s Dec: -12°05m44.0s

Equation 1

$$A_e = \frac{1380(T_{Alcp}+T_{Arcp})K_s}{S_o} \ [\mathrm{m}^2]$$

Equation 2

$$\epsilon_{ap} = \frac{A_e}{A_p}$$

$$A_p = \frac{\pi}{4}D^2 \quad D = 25.9 \text{ m}$$

Equation 3

$$PSS_{lcp} = \frac{(S/2)}{K_s T_{Alcp}} \text{ and } PSS_{rcp} = \frac{(S/2)}{K_s T_{Arcp}} \ [\text{Jy K}^{-1} \text{ per polarisation}]$$

Thank You

Contact Details

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Image credit: Lynne Arnold, 2019