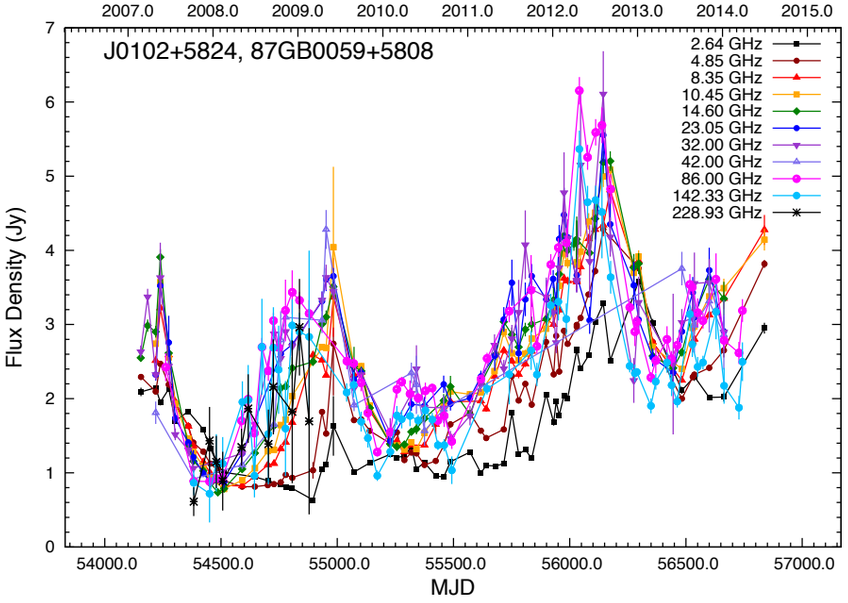
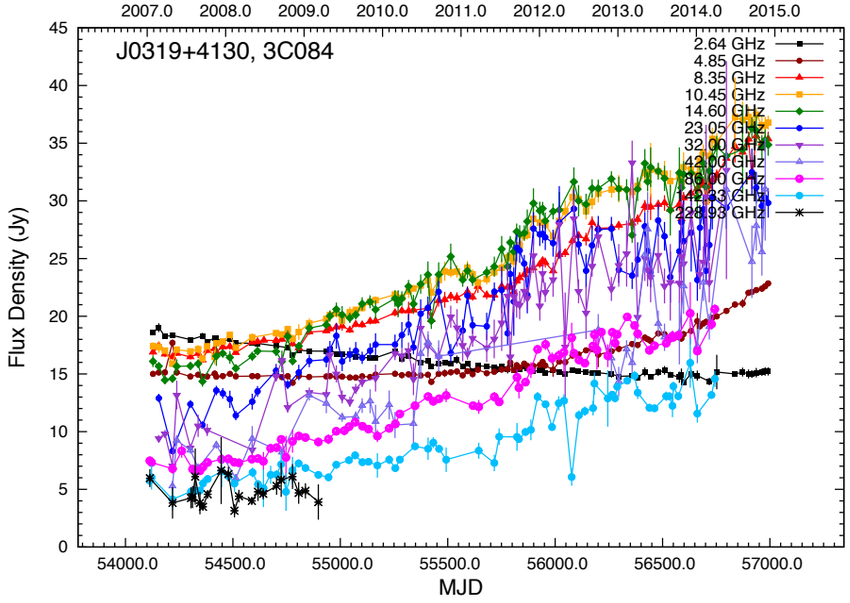
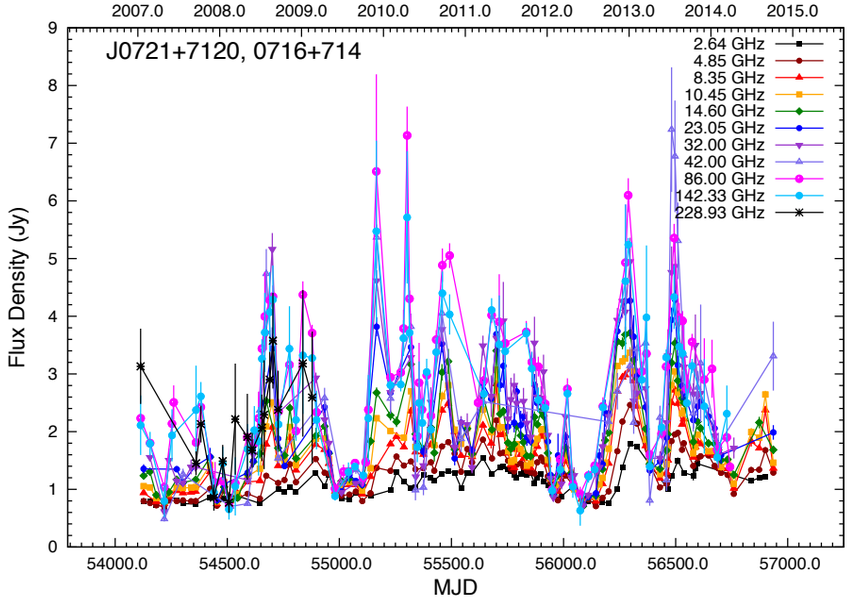
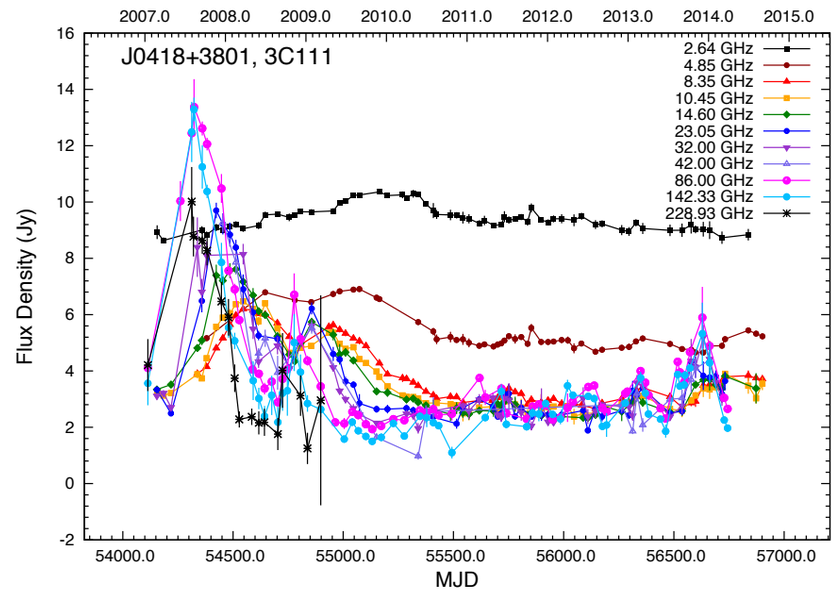
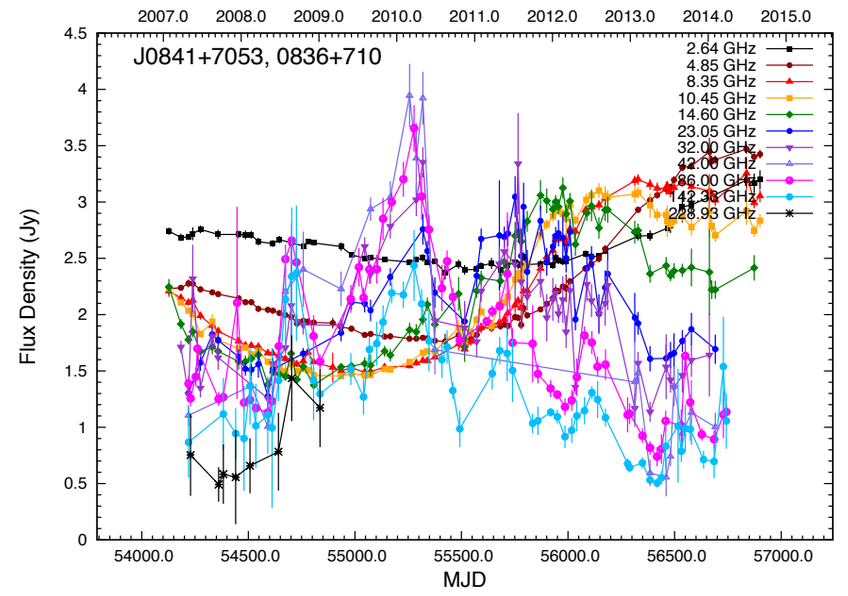
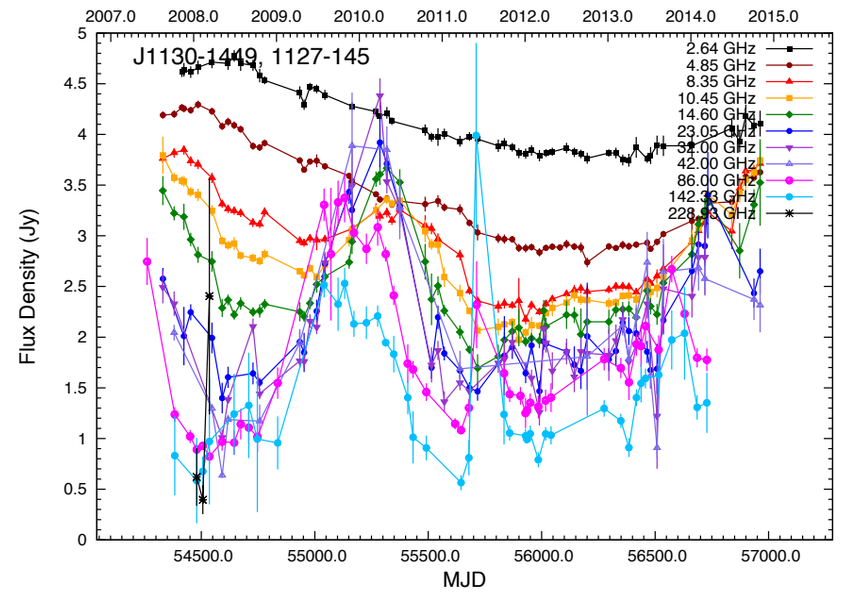


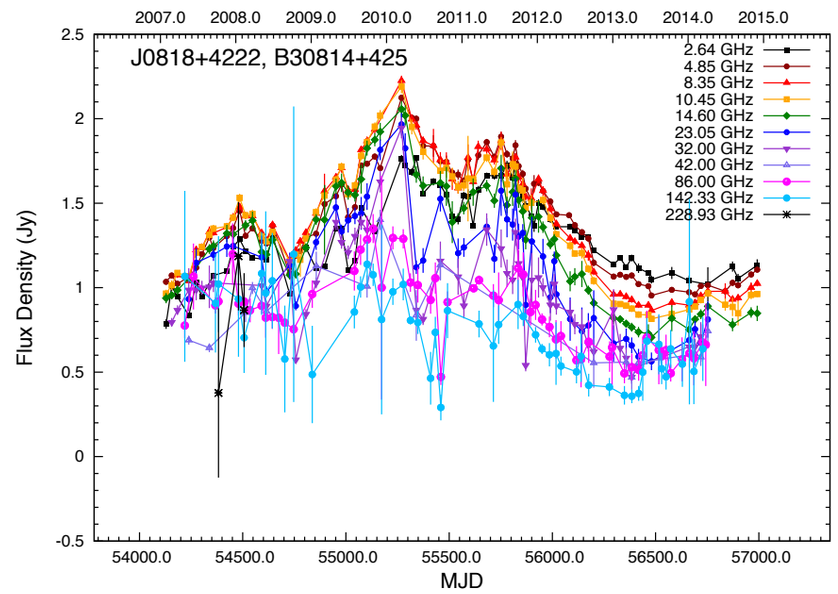


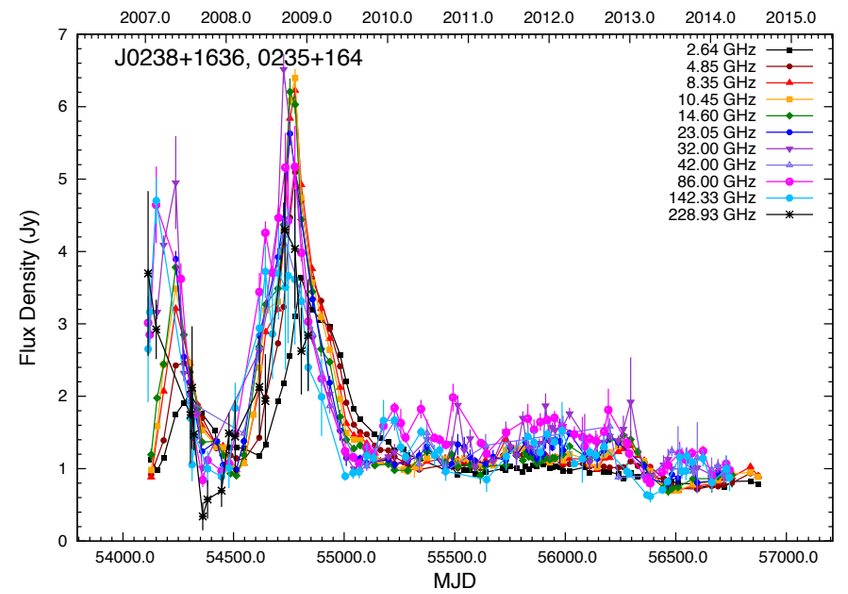


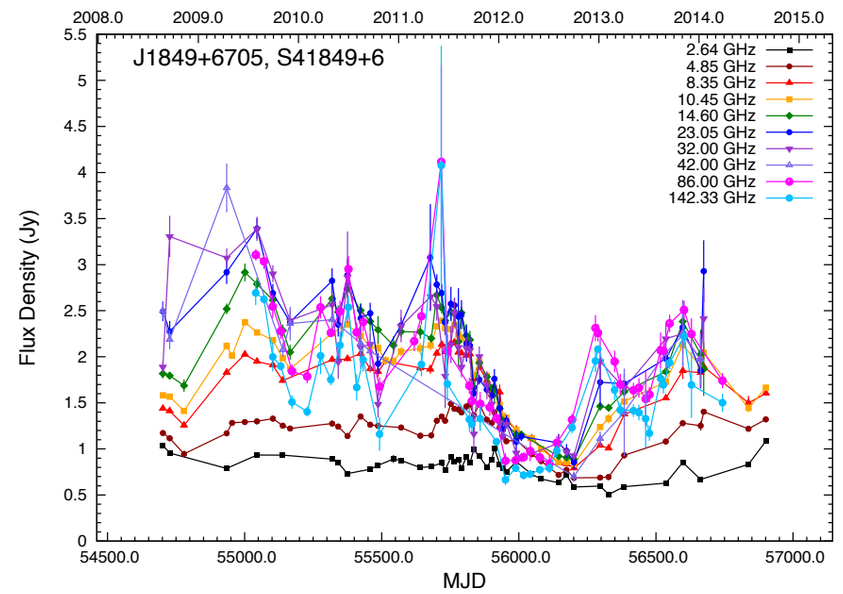




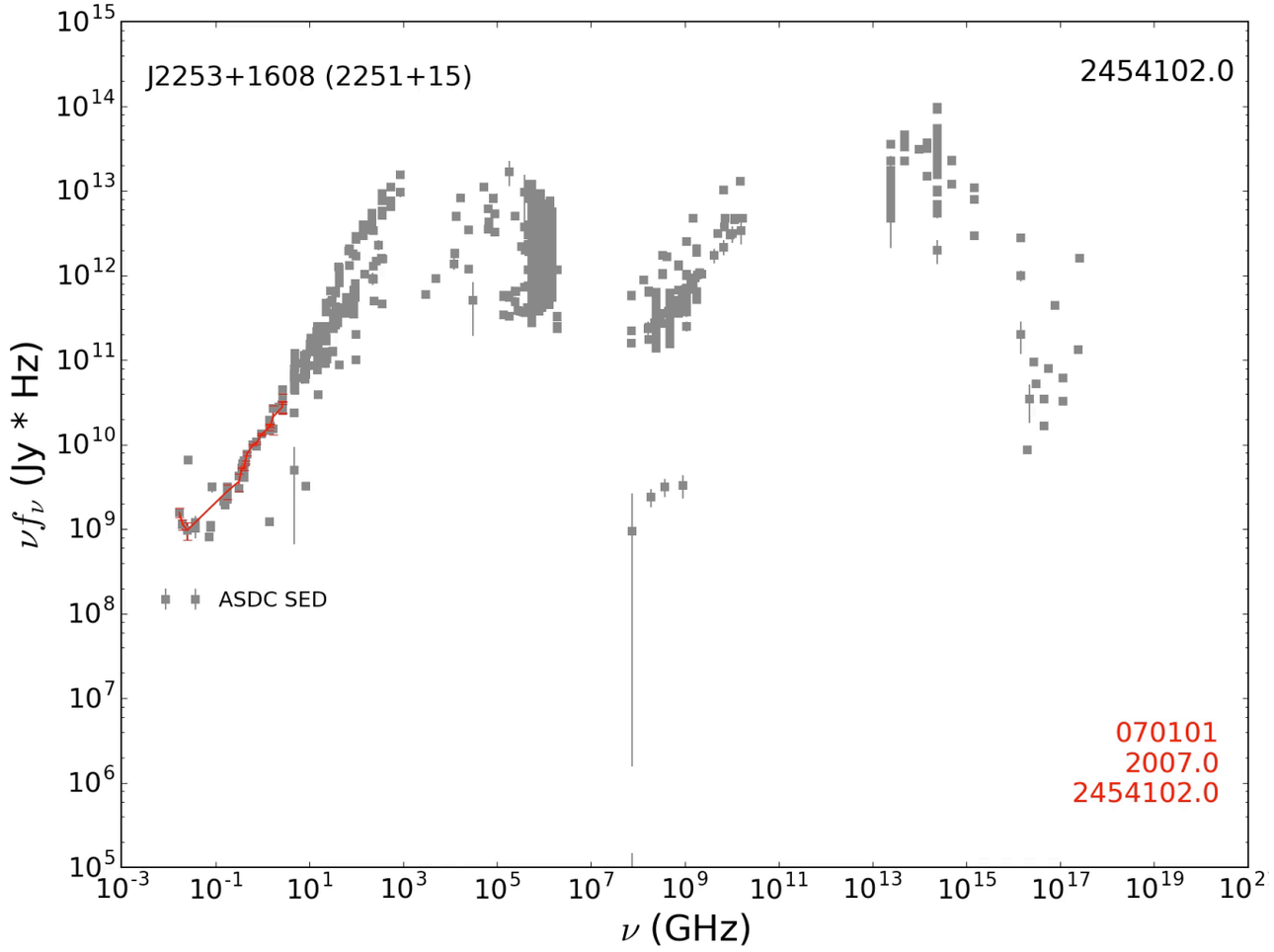


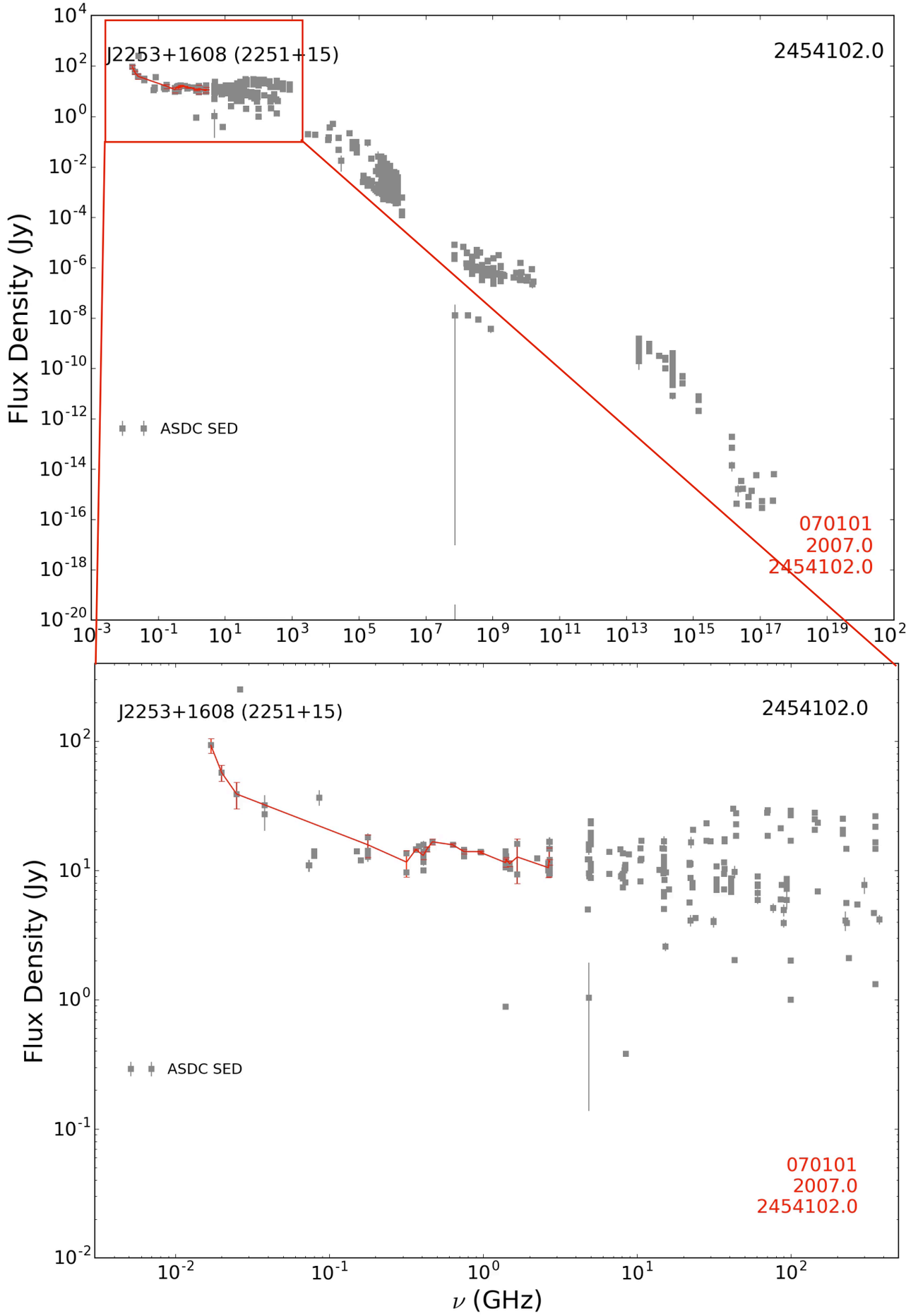






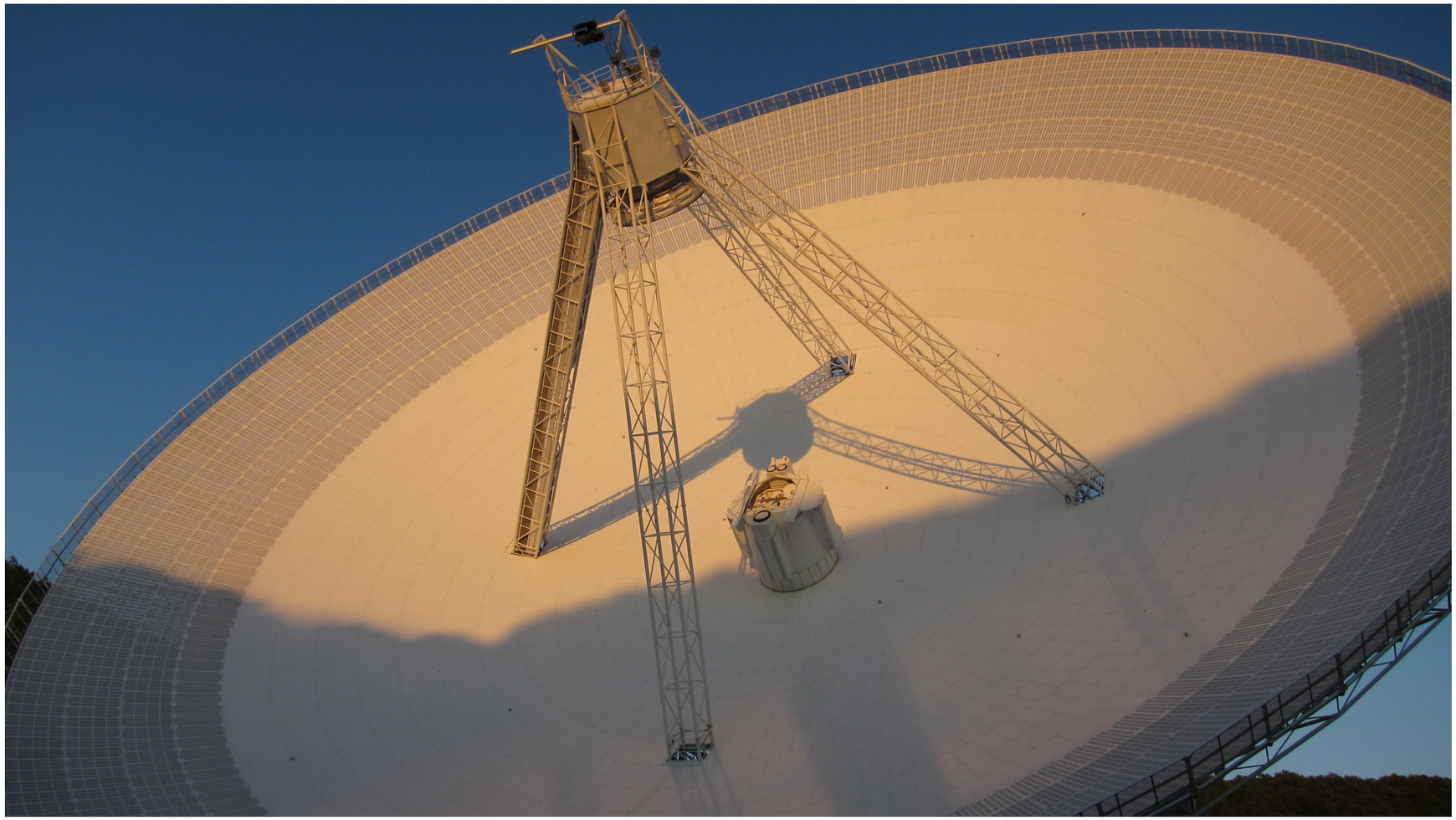
www3.mpifr-bonn.mpg.de/div/vlbi/fgamma/

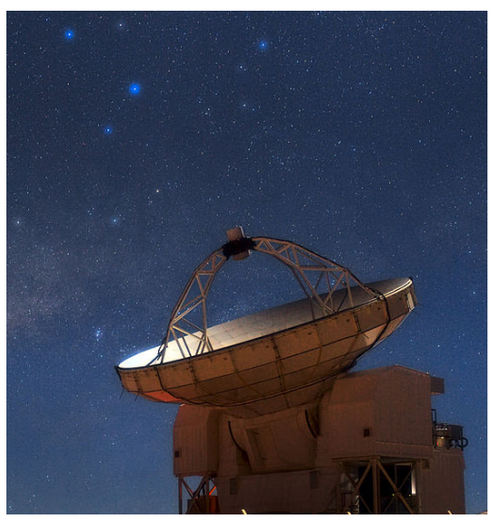




Angelakis et al. in prep.

www3.mpifr-bonn.mpg.de/div/vlbi/fgamma/





the F-GAMMA program (Jan 2007 — Jan 2015):

- almost 90 mostly *Fermi* sources
- 2.64 - 142, 345 GHz at 11 frequency steps
- mean cadence 1.3 months

Fuhrmann, Angelakis et al. 2016A&A…596A..45F
www3.mpifr-bonn.mpg.de/div/vlbi/fgamma/

QUVI radio multi-frequency monitoring of *Fermi* blazars; Physical processes in AGN jets

E. Angelakis, I. Myserlis & J. A. Zensus
Max-Planck-Institut für Radioastronomie, Auf dem Huegel 69, Bonn 53121, Germany

on behalf of the F-GAMMA team

(part of Ioannis Myserlis' Thesis)

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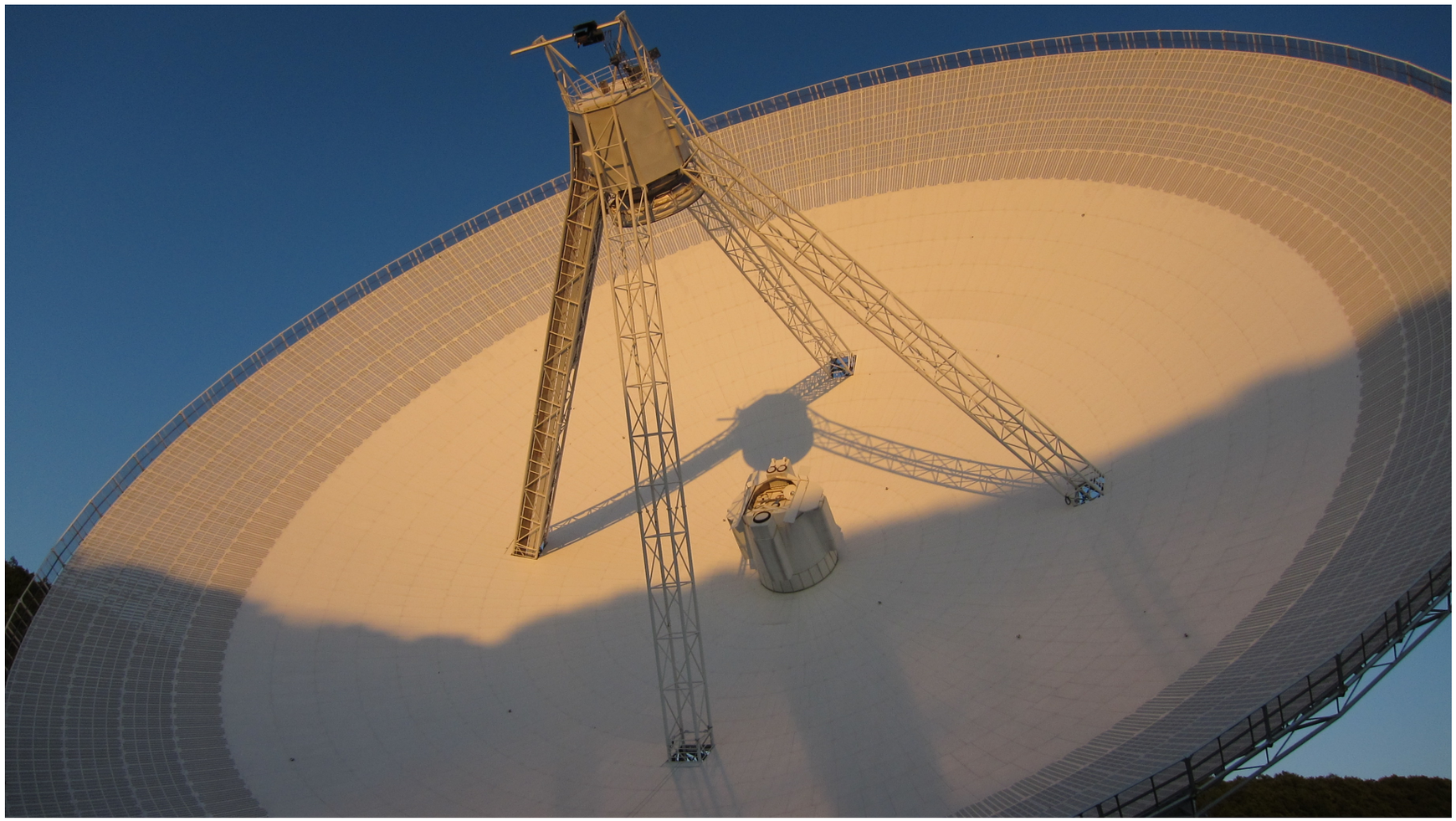
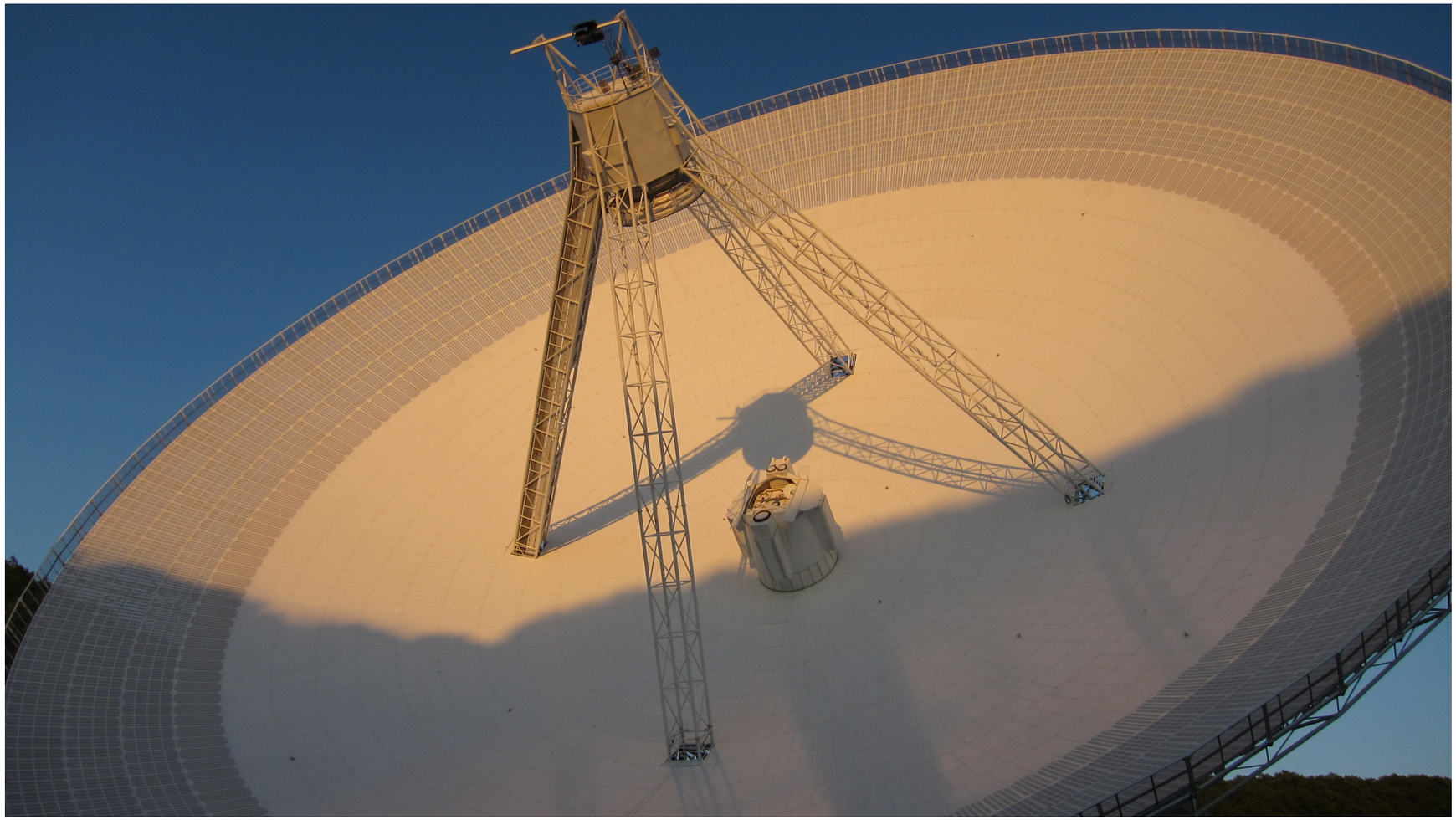
für Radioastronomie



the F-GAMMA program (Jan 2007 — Jan 2015):

- almost 90 mostly *Fermi* sources
- 2.64 - 142, 345 GHz at 11 frequency steps
- mean cadence 1.3 months
- **LP** at 2.64, 4.85, 8.35, 10.45 and 14.6 GHz
- **CP** at 2.64, 4.85, 8.35, 10.45, 14.6, 23.05 GHz

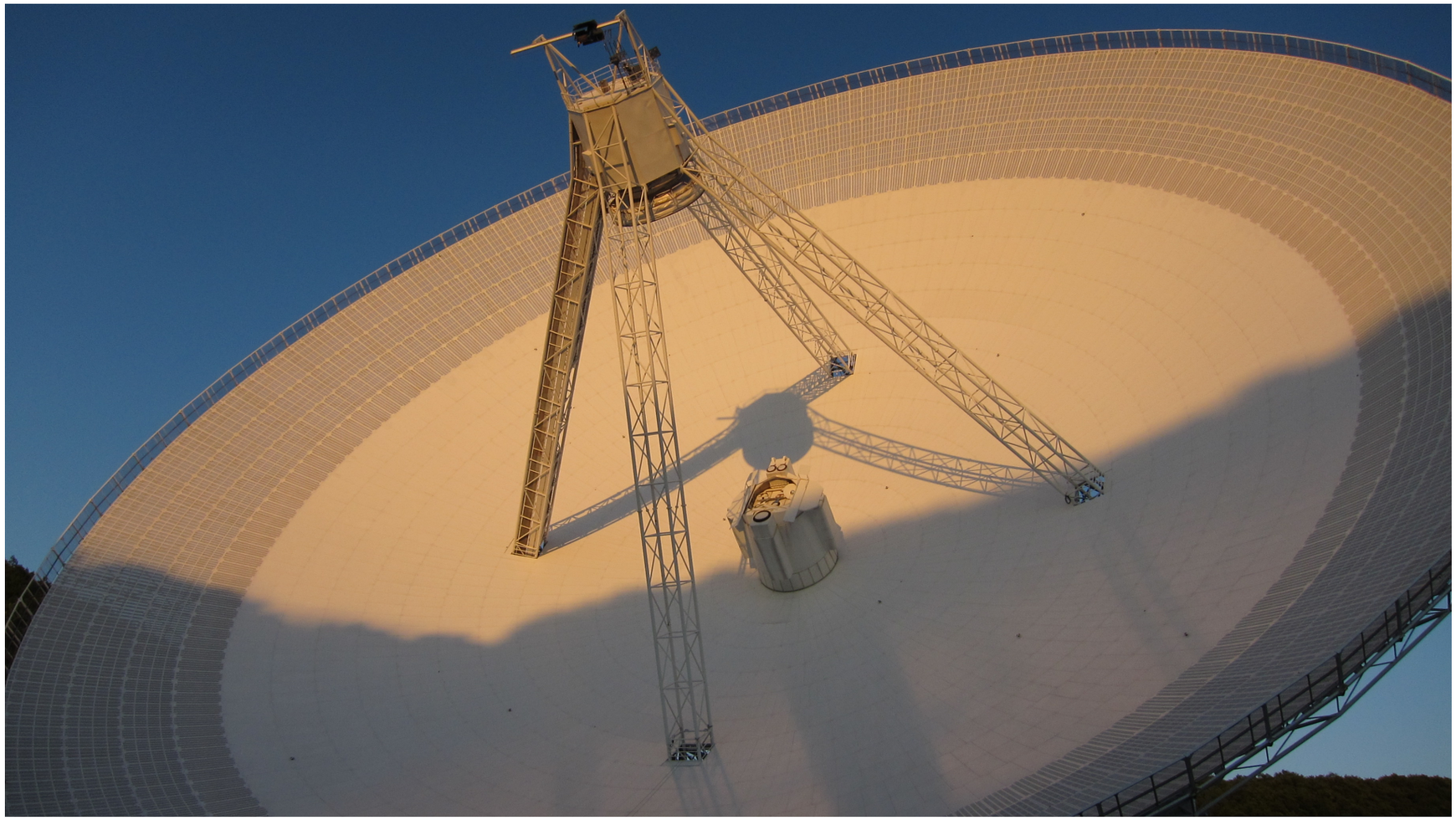
Myserlis, Angelakis et al. 2016Galax…4…58M
Angelakis, Myserlis & Zensus, Galaxies, doi: 10.20944/preprints201708.0108.v1



the Radiopol since 2015 …

- almost 18 *Fermi* sources
- 2.64 - 43 GHz
- **LP** at 2.64, 4.85, 8.35, 10.45 and 14.6 GHz
- **CP** at 2.64, 4.85, 8.35, 10.45, 14.6, 23.05 GHz
- mean **cadence 2** weeks

Myserlis, Angelakis et al. 2016Galax…4…58M
Angelakis, Myserlis & Zensus, Galaxies, doi: 10.20944/preprints201708.0108.v1

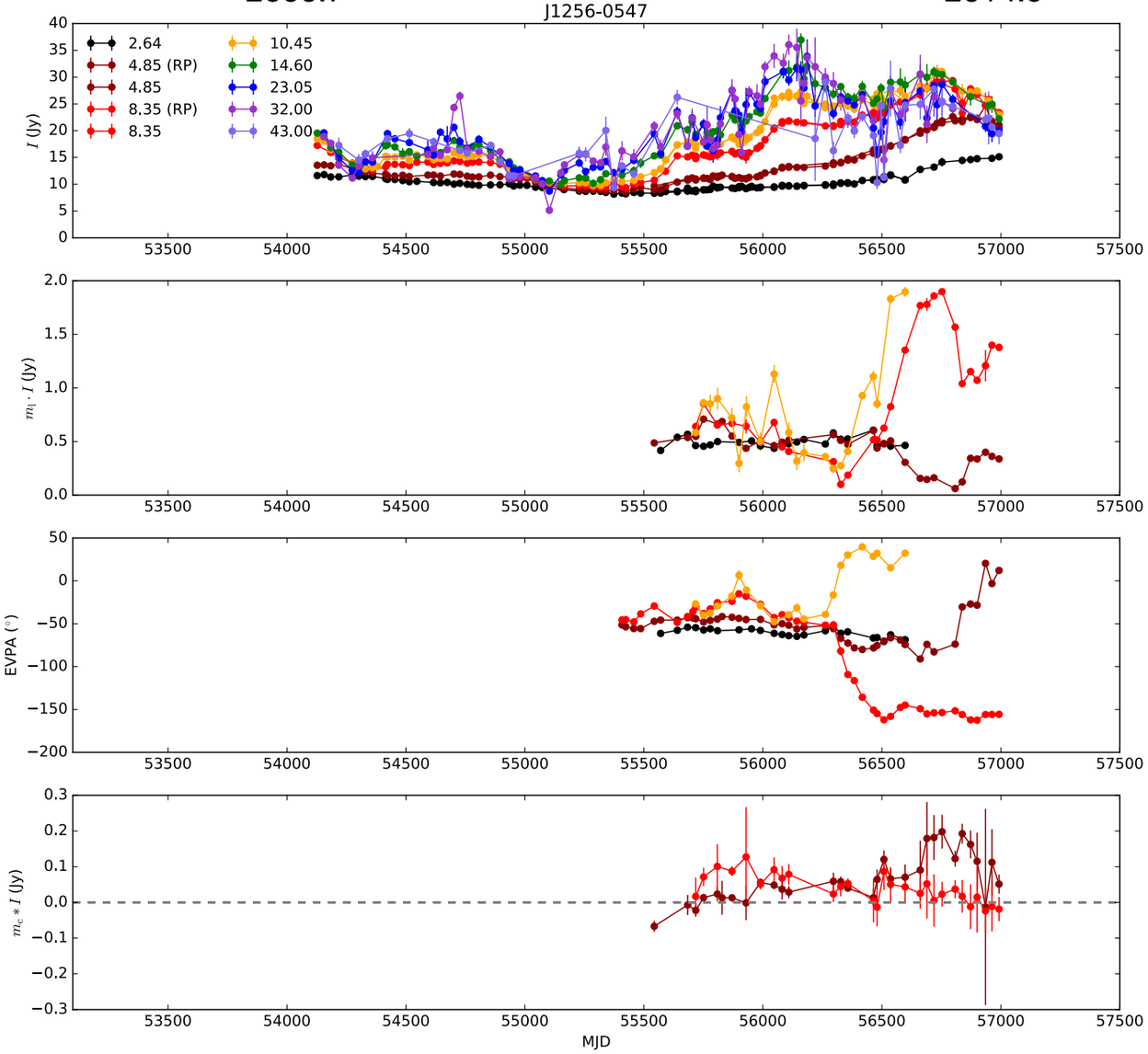


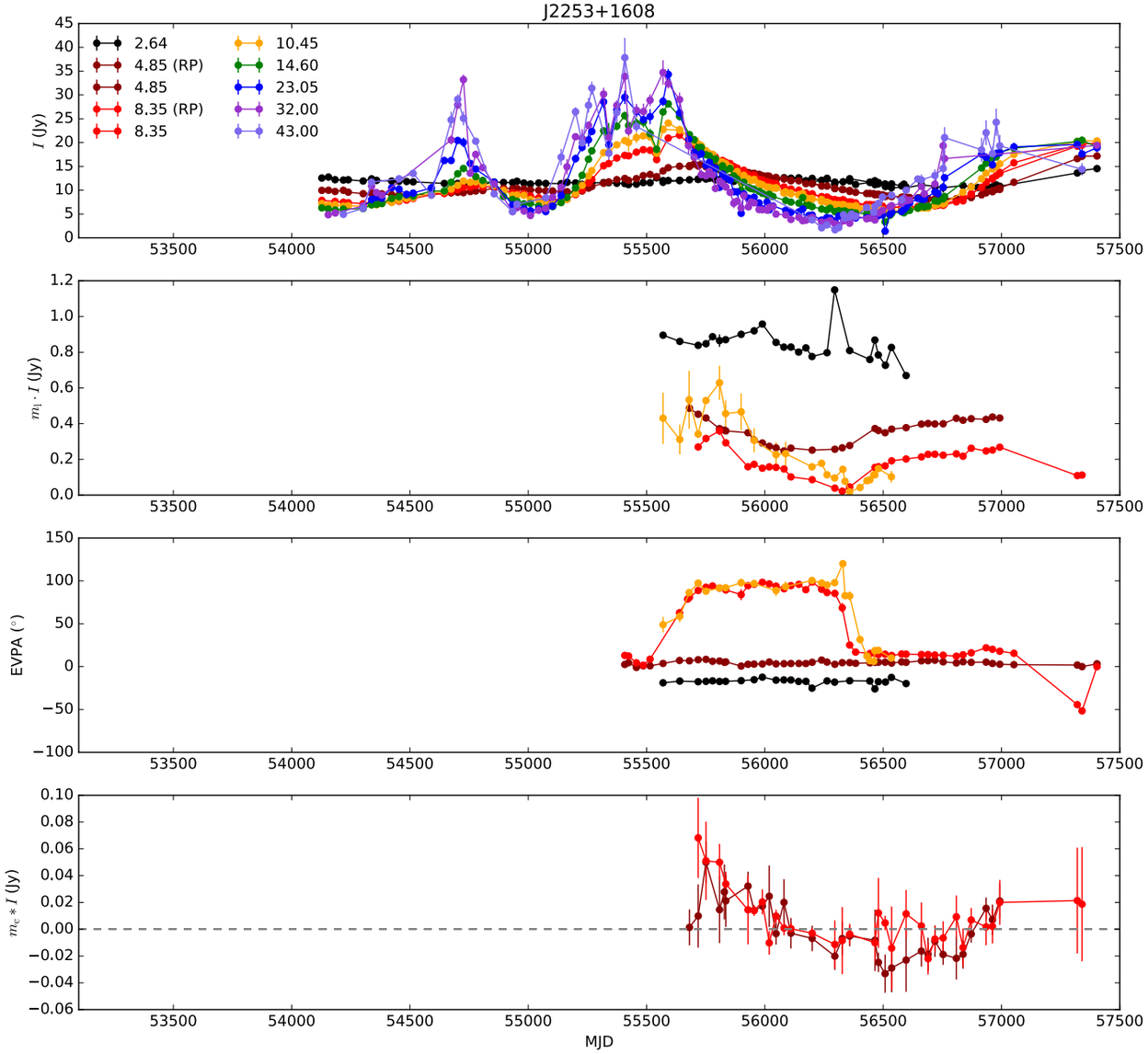
the Radiopol since 2015 …

- ➡ Uncertainties:
  - LP degree: 0.1 %
  - CP degree: 0.1—0.2 %
  - EVPA: 1°
- ➡ vast dataset of almost **90 srcs, 5 LP and 6 CP over at least 8 + 2 +… years**

Myserlis, Angelakis et al. 2016Galax…4...58M

Myserlis et al. 2017, A&A, arXiv: 170604200M



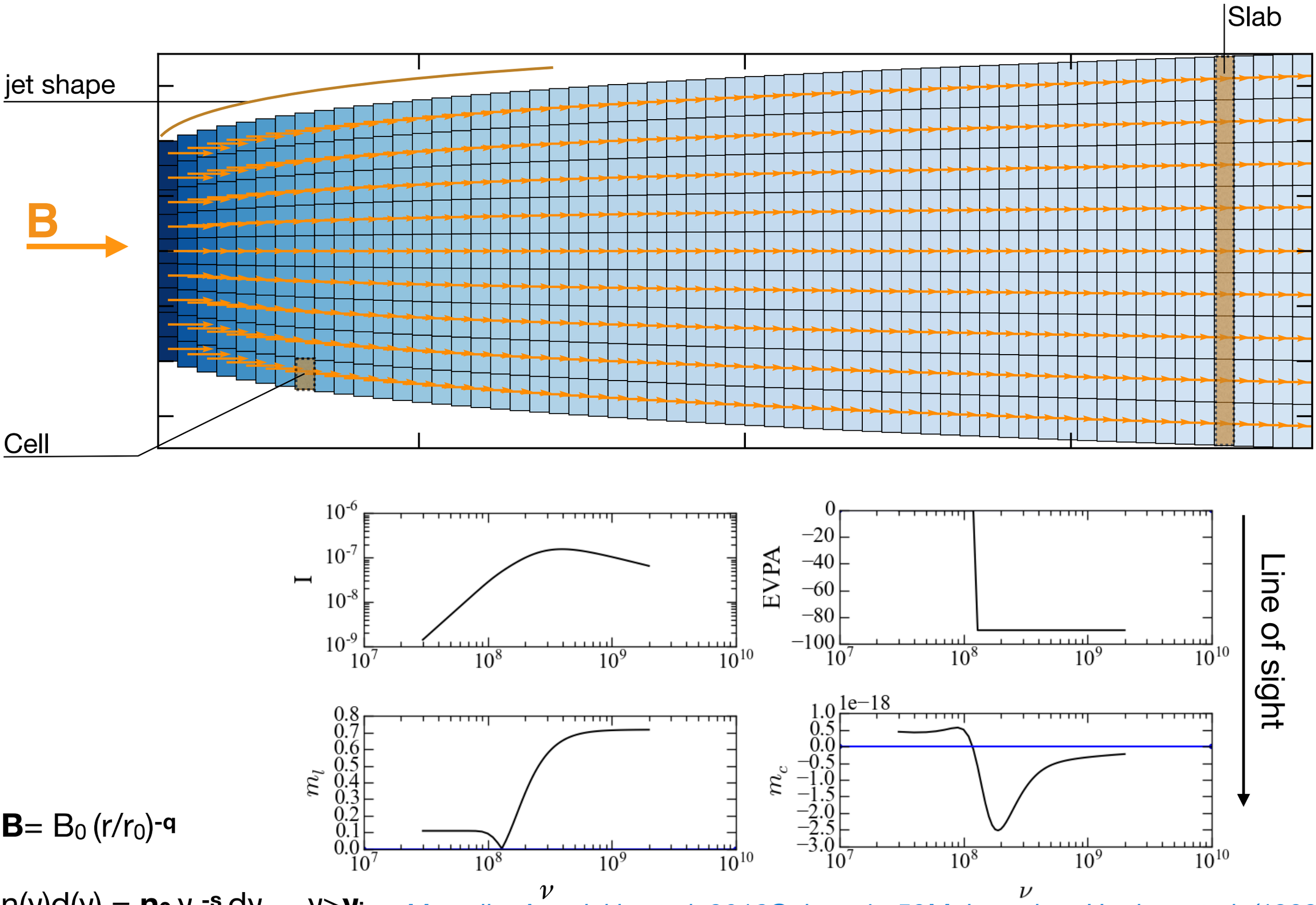


the picture: variability caused by episodic activity that undergo spectral evolution. We assume:

- magnetised jet with a partially uniform magnetic field,
- occasional traveling disturbances create shocks,
- particles at the shocked areas get re-energised and radiate flaring emission which undergoes spectral evolution

Myserlis et al. in prep.

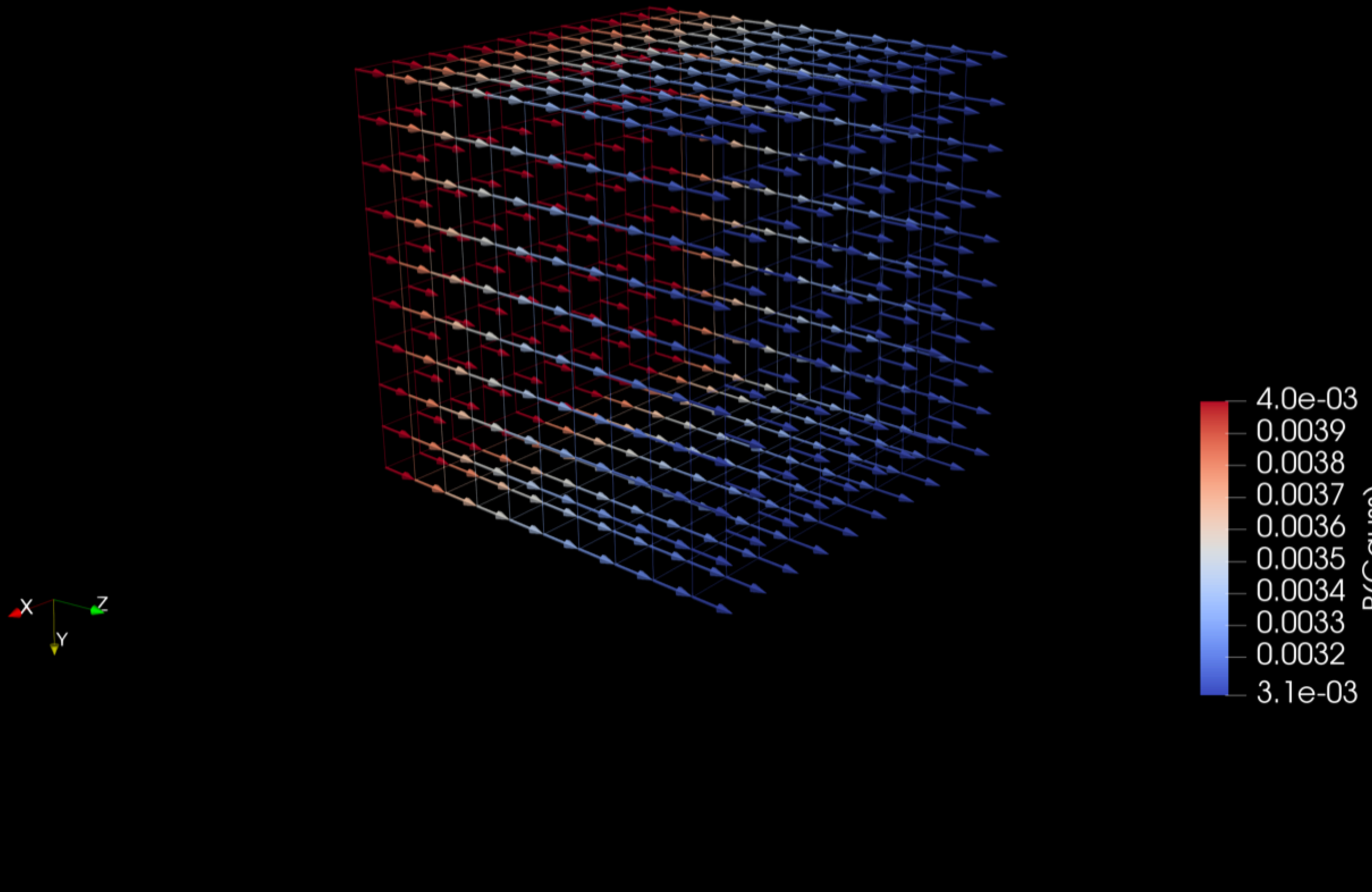
Angelakis, Myserlis & Zensus, Galaxies, doi: 10.20944/preprints201708.0108.v1

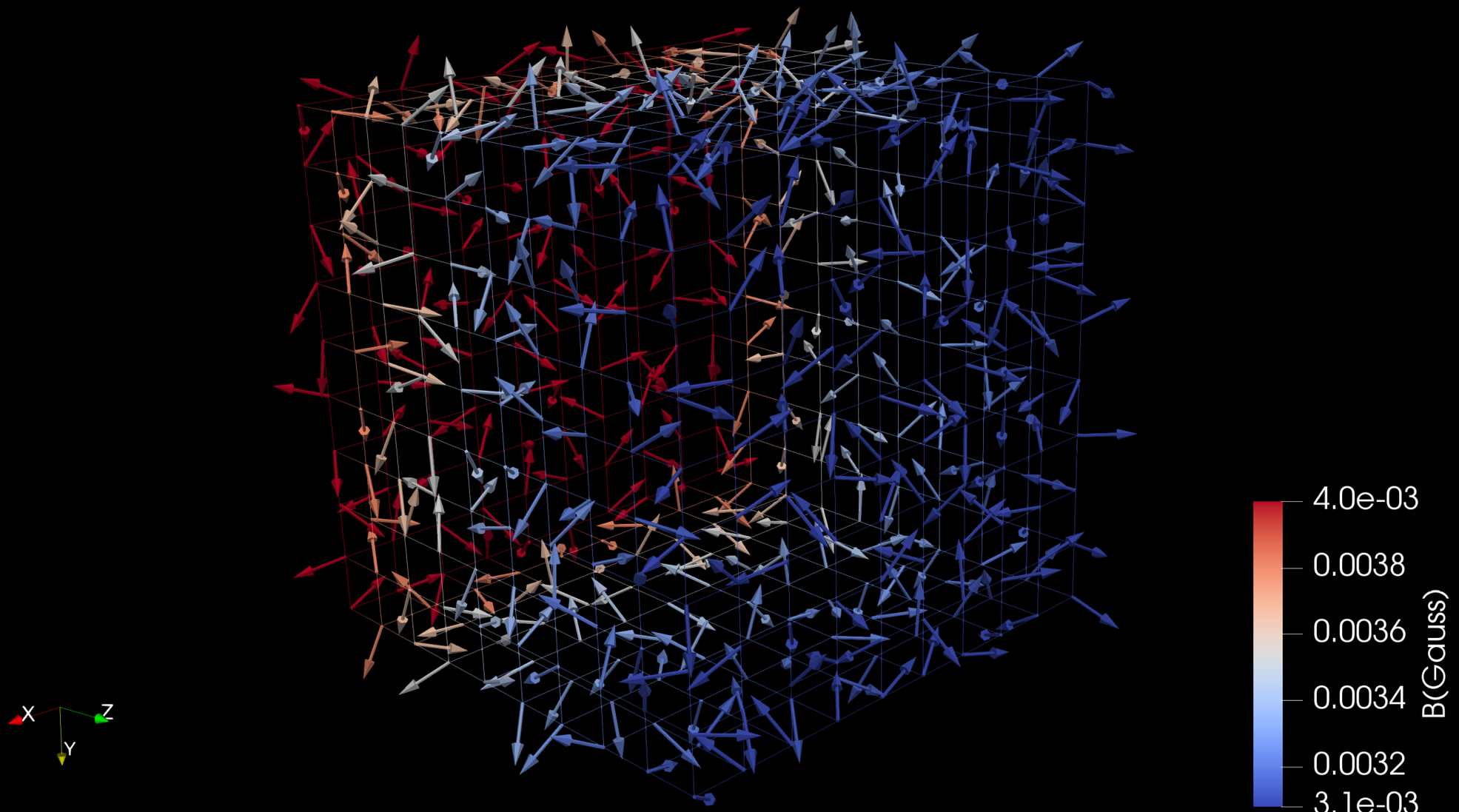


B= $B_0 (r/r_0)^{-q}$

$n(\gamma)d(\gamma) = \mathbf{n_0}\, \gamma^{-s}\, d\gamma, \quad \gamma > \boldsymbol{\gamma_i}$

Myserlis, Angelakis et al. 2016Galax...4...58M, based on Hughes et al. (1989)


X
Z
Y
4.0e-03
0.0039
0.0038
0.0037
0.0036
0.0035
0.0034
0.0033
0.0032
3.1e-03
B(Gauss)


X
Z
Y
4.0e-03
0.0038
0.0036
0.0034
0.0032
3.1e-03
B(Gauss)

jet shape

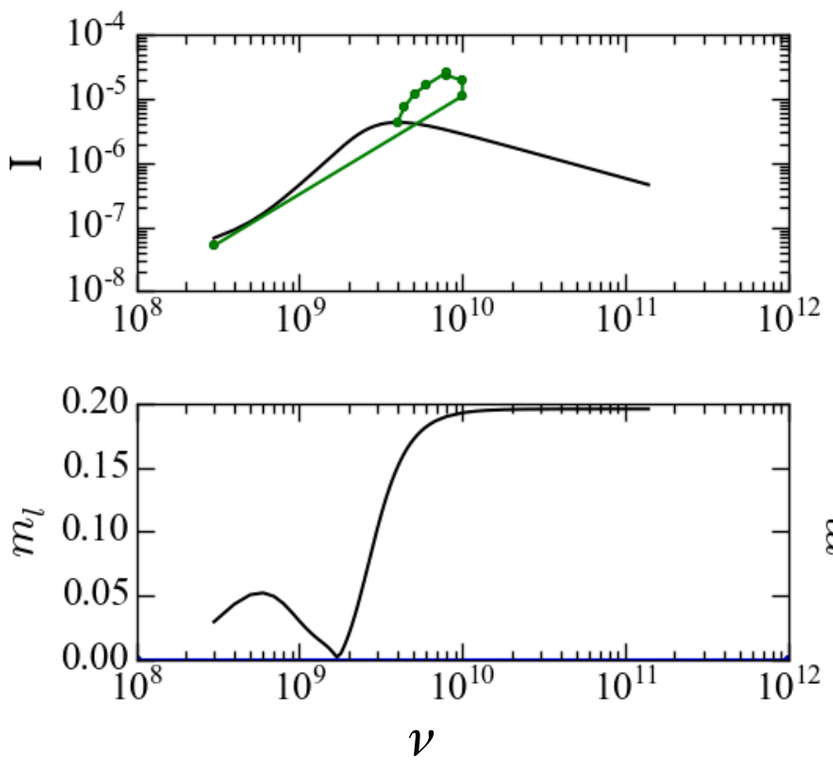
k
compression
factor

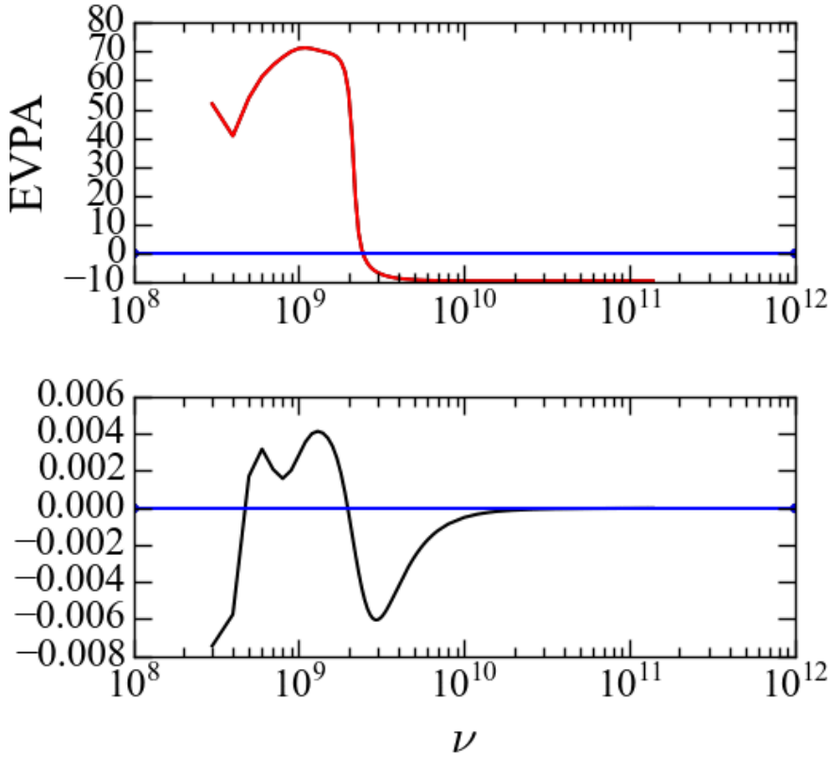
Cell

Density
$$n'_0 = n_0 k^{-\frac{s+3}{6}}$$

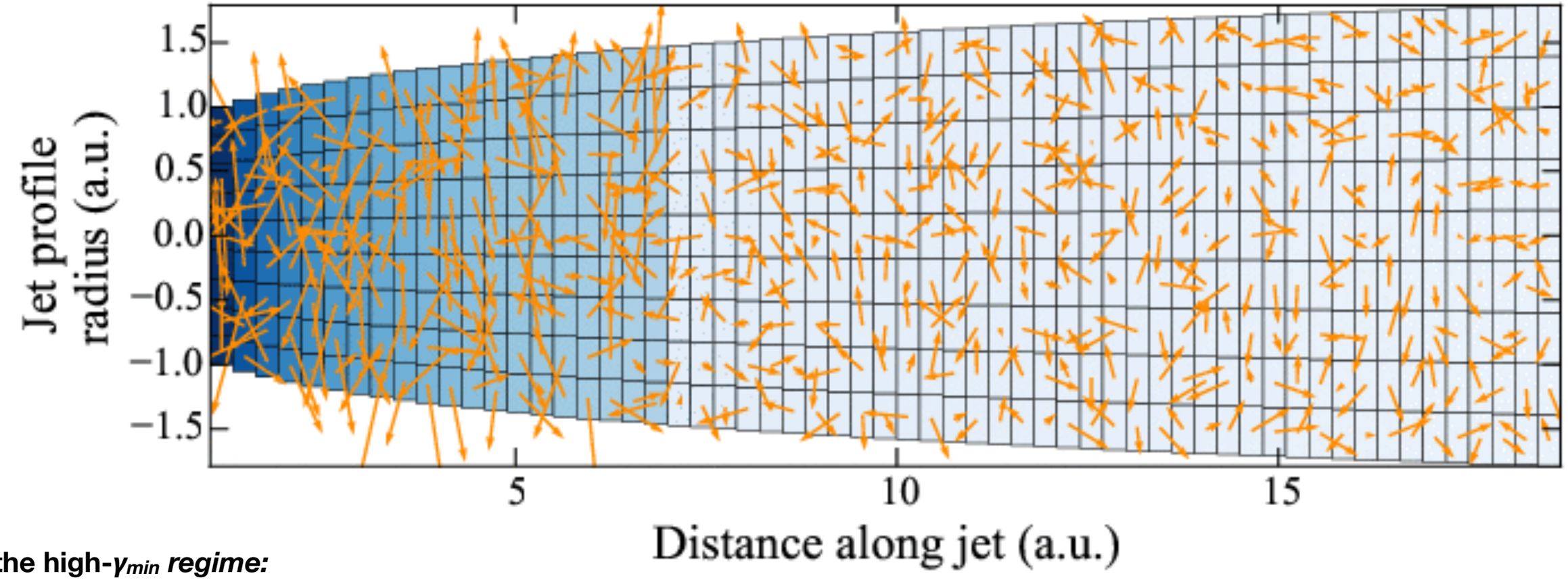
Lower energy cutoff
$$E'_{\rm min} = E_{\rm min} k^{-\frac{1}{3}}$$

B-field strength
$$B' \sim kB$$





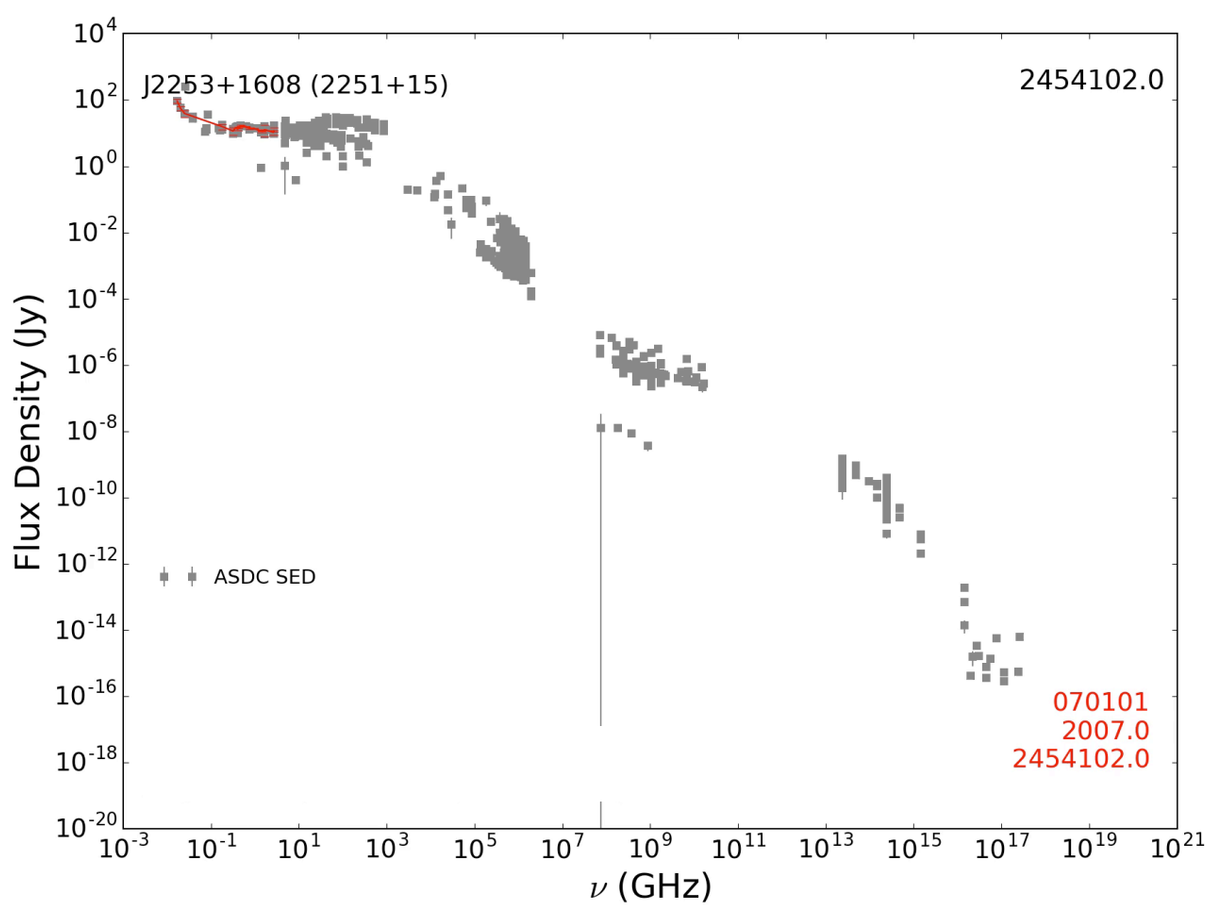
Line of sight



the high-γ_{min} *regime:*

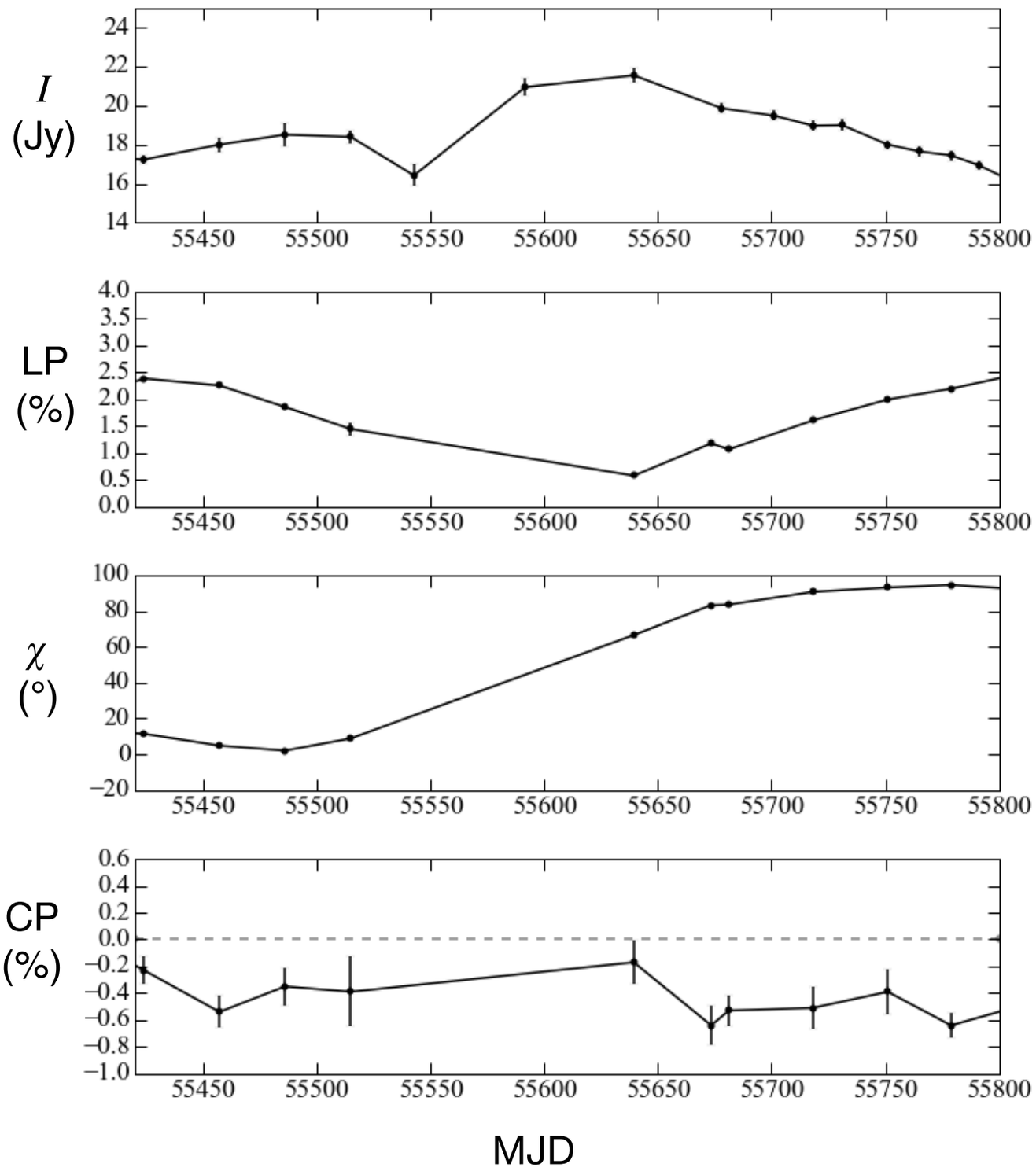
Shock parameters

- each cell has a 100% uniform B-field parallel to the jet with 5% of the amplitude of the local field
- Compression factor: $k = 0.8$
- γ_{min}~10^4
- Doppler factor: D ~ 30
  Consistent with D_{var} at 37 GHz
  Hovatta et al. (2009)
- Jet plasma parameters
  - Density: n_0 = 10 - 100 cm^{-3}
  - Magnetic field coherence length: 9 pc

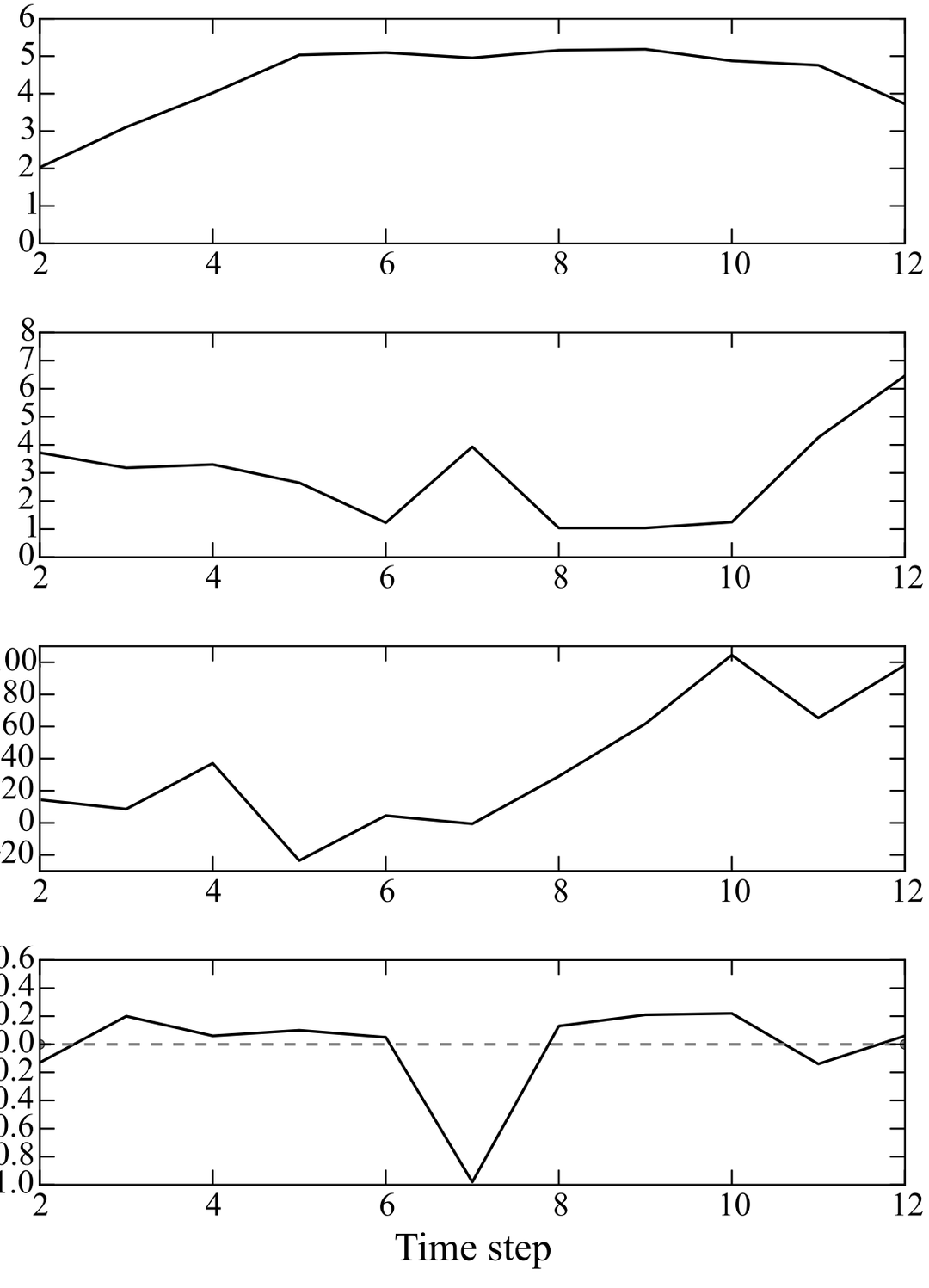


Myserlis, Angelakis et al.,in prep.
Myserlis et al., Galaxies, vol. 4, issue 4, p. 58
Angelakis, Myserlis, submitted to Galaxies

Observed lightcurves
8.35 GHz



Synthetic lightcurves
8.35 GHz



Myserlis, Angelakis et al.,in prep.
Myserlis et al., Galaxies, vol. 4, issue 4, p. 58

the low-γ_{min} *regime:* NGC 4845

Irwin et al, 2015,ApJ…809..172I

- evolving convex radio spectrum with a peak around 3-5 GHz
- LP: practically zero (0.1–0.5 %) at both 1.5and 5 GHz ✘
- CP:
  - unusually high at 1.5 GHz: 2–3 % ✔
  - zero at 5 GHz ✔

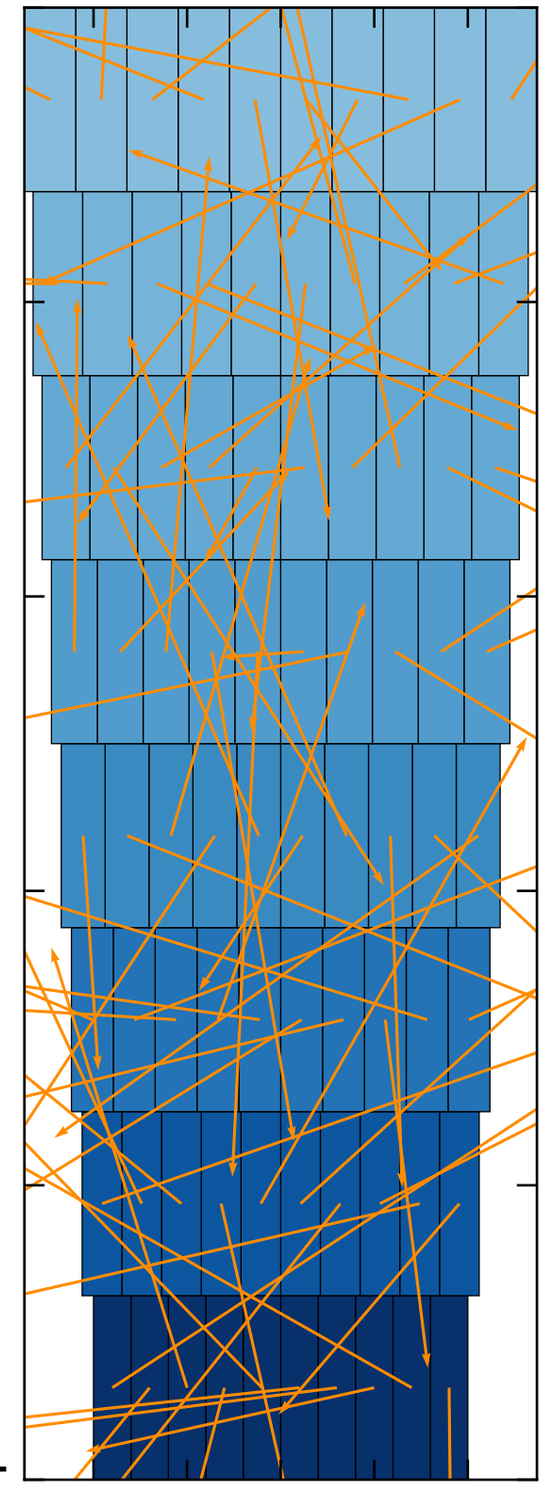
we examined whether the high CP is caused by converting linear to circular polarisation

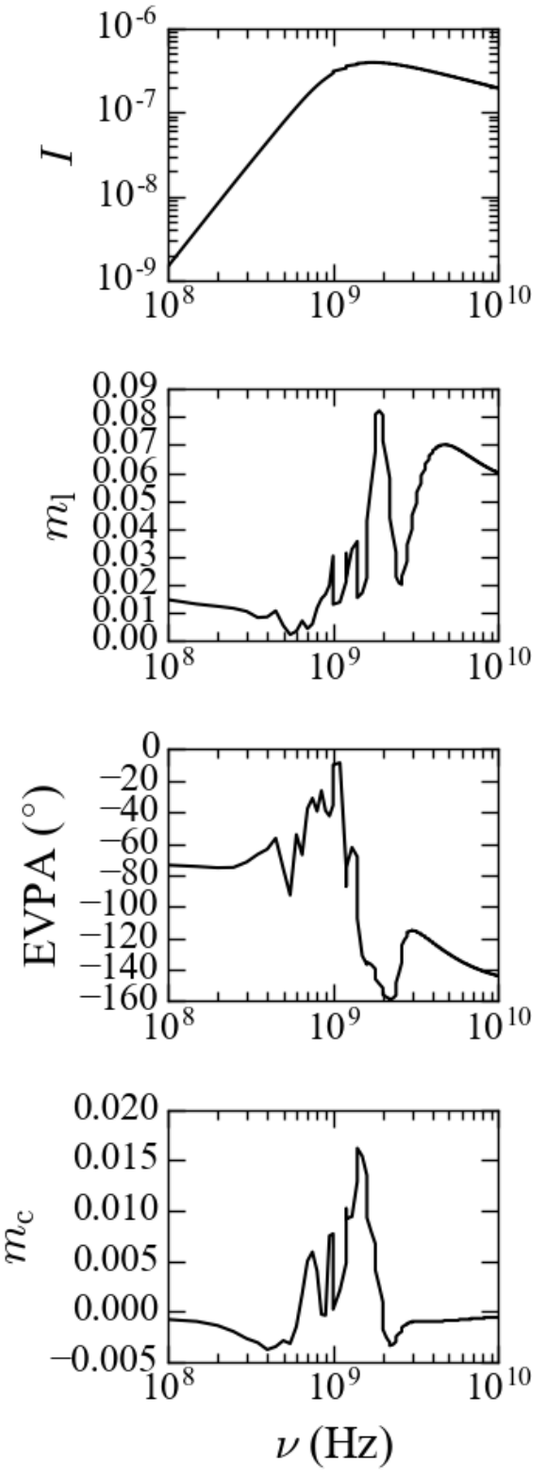
Realisation

- conical adiabatically expanding outflow
- random B-field
- γ_{min} ~10–100

We find:

- there is transformation of LP to CP at 1.5 GHz Faraday conversion, hence:
  - the low LP and high CP degrees
- **Low LP** at 5 GHz **cannot** be reproduced with this realisation.
  - an excess of low-energy magnetized plasma within or around the flow may be causing de-polarisation through Faraday rotation.





To summarise:

- vast dataset: 90 srcs, 5 LP and 6 CP over at least 8 + 2 +… years
  - 11300 data points with Full-Stokes (I, Q, U, V)

- Toy model: shock-driven variability and evolution works well both at:

  - high gamma_min regime: Compression factor: k = 0.8, Doppler factor: D ~ 30, Density: n_0 = 10^1 - 10^2 cm^{-3} , Magnetic field coherence length: 9 pc, Density: n_0 = 10^1 - 10^2 cm^{-3}, Magnetic field coherence length: 9 pc
  - low gamma_min regime:
    - Faraday effects play a key role: ↓ LP & ↑ CP at low frequencies
    - excess of thermal plasma in within or around the outflow?

- and the reproduction of physical processes

- next step is to examine recursive events with variable conditions

To summarise:

Myserlis, Angelakis et al. 2016Galax…4...58M

Angelakis, Myserlis & Zensus, Galaxies, doi: 10.20944/preprints201708.0108.v1

Polarised Emission from Astrophysical Jets

12-16 June 2017, Ierapetra

http://www3.mpifr-bonn.mpg.de/old_mpifr/jetpol/jetpol/Home.html

Peer-reviewed proceedings at:
http://www.mdpi.com/journal/galaxies/special_issues/astrophysical_jets

Thank you!

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Max-Planck-Institut für Radioastronomie, Auf dem Huegel 69, Bonn 53121, Germany

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Max-Planck-Institut
für Radioastronomie

Source	Survey name	RA	DEC	Epoch
J0841+7053	0836+710	08:41:24.38	+70:53:41.8	J2000
J1130-1449	1127-145	11:30:07.05	-14:49:27.4	J2000
J1229+0203	3C 273	12:29:06.70	+02:03:08.5	J2000
J1256-0547	3C 279	12:56:11.17	-05:47:21.7	J2000
J1512-0905	PKS 1510-089	15:12:50.53	-09:05:59.8	J2000
J1642+3948	3C 345	16:42:58.80	+39:48:37.0	J2000
J2202+4216	BL Lac	22:02:43.28	+42:16:40.1	J2000
J2229-0832	2227-088	22:29:40.08	-08:32:54.4	J2000
J2232+1143	CTA 102	22:32:36.40	+11:43:51.0	J2000
J2253+1608	3C 454.3	22:53:57.74	+16:08:53.6	J2000
J0854+2006	OJ 287	08:54:48.90	+20:06:30.9	J2000
J0324+3410	1H 0323+342	03:24:41.1	+34:10:46	J2000
J0849+5108	SBS 0846+513	08:49:58.0	+51:08:29	J2000
J0948+0022	PMN J0948+0022	09:48:57.3	+00:22:26	J2000
J1505+0326	PKS 1502+036	15:05:06.5	+03:26:31	J2000
J1644+2619	FBQS J1644+2619	16:44:42.50	+26:19:13.0	J2000
J1222+0413	SDSS J122222.55+041315. 7	12:22:22.50	+04:13:16.0	J2000
J1443+4725	B3 1441+476	14:43:18.50	+47:25:57.0	J2000

Myserlis et al. 2017, A&A, arXiv: 170604200M
Myserlis et al. 2016, Galaxies, 4, 58
Angelakis, Myserlis & Zensus submitted to Galaxies