Excited OH Masers In Star-forming Regions

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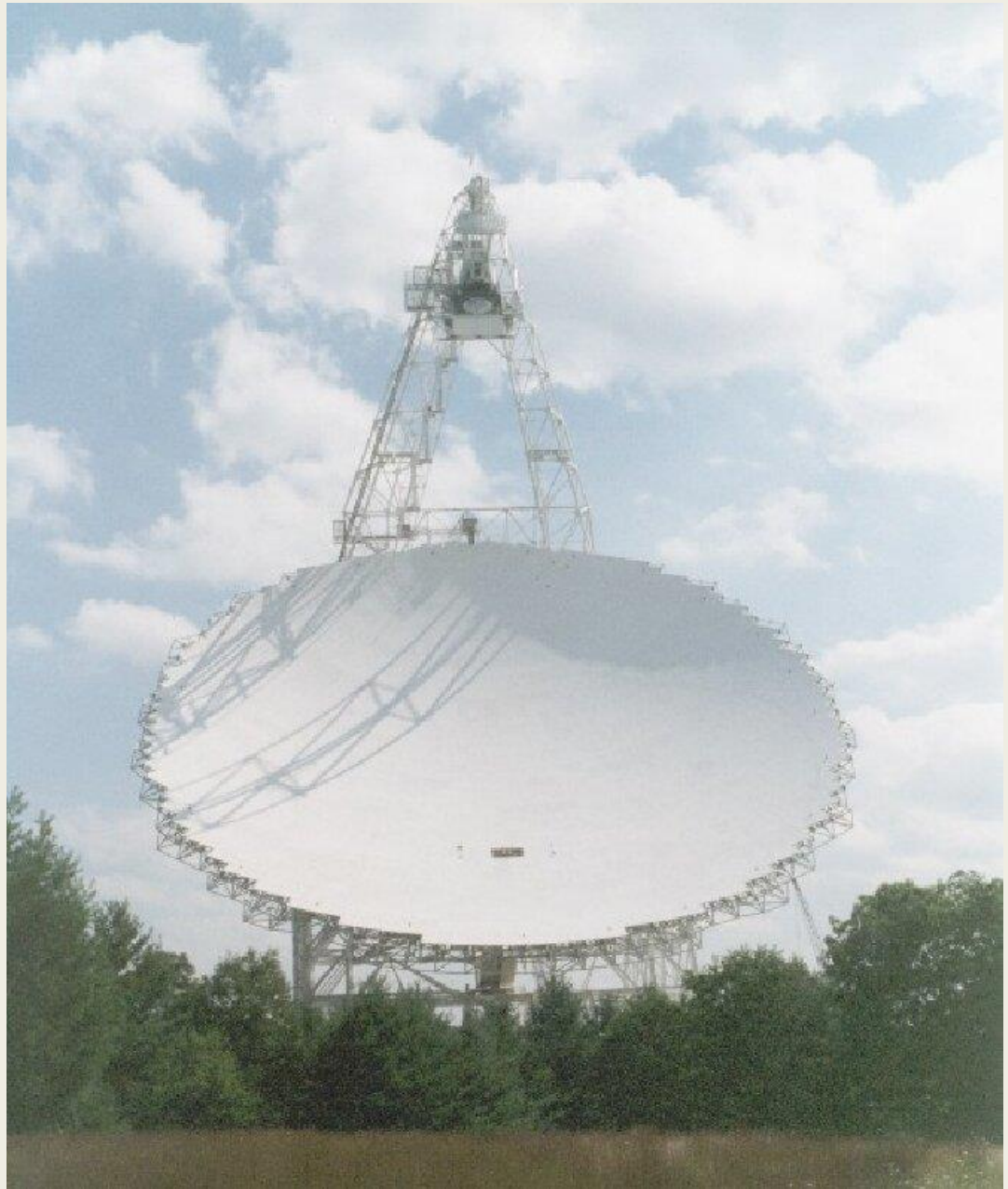
100m Green Bank Radio Telescope



VEGAS C-band backend in mode 15

8 bands each consisting of 32,678 channels in full Stokes mode:

4.660, 4.750, 4.765 exOH

6.016, 6.031, 6.035, 6.049 exOH

Velocity resolution ~ 0.03 km s^{-1}, Velocity coverage ~ 300 km s^{-1}

Linear Polarisation Calibrator = 3C138 or 3C286

Used position-switching for calibrators, and frequency-switching for spectra.

	Source	4.660	4.750	4.765	6.016	6.030	6.035	6.049
1	G108.758-0.986						M: L, C	
2	G111.526+0.893			M			M: L, C	
3	G111.532+759						M: L, C	
4	G111.542+0.777		E	M		M	M: L, C	
5	G126.715-0.822	NO DETECTIONS						
6	G133.715+1.215		A	M	A	A	A	
7	G133.947+1.064	A	E	M	A	M: L, C	M: L, C	E, M
8	G141.918+1.902					M: C	M: L, C	
9	G163.078-1.926	NO DETECTIONS						
10	IRAS 05137+3919							
12	G173.482+2.446			M: C				
13	IRAS05382+3547	NO DETECTIONS						
14	G183.349-0.575						M: L, C	
15	G188.946+0.886			M				
16	G189.030+0.783						M: L, C	
17	G196.454-1.677			M				
18	G211.567-19.28	NO DETECTIONS						
21	G213.705-12.60	A?	E	E, M	A?	A	A	
19	G232.621+0.996							
20	G240.316+0.071						M: C	

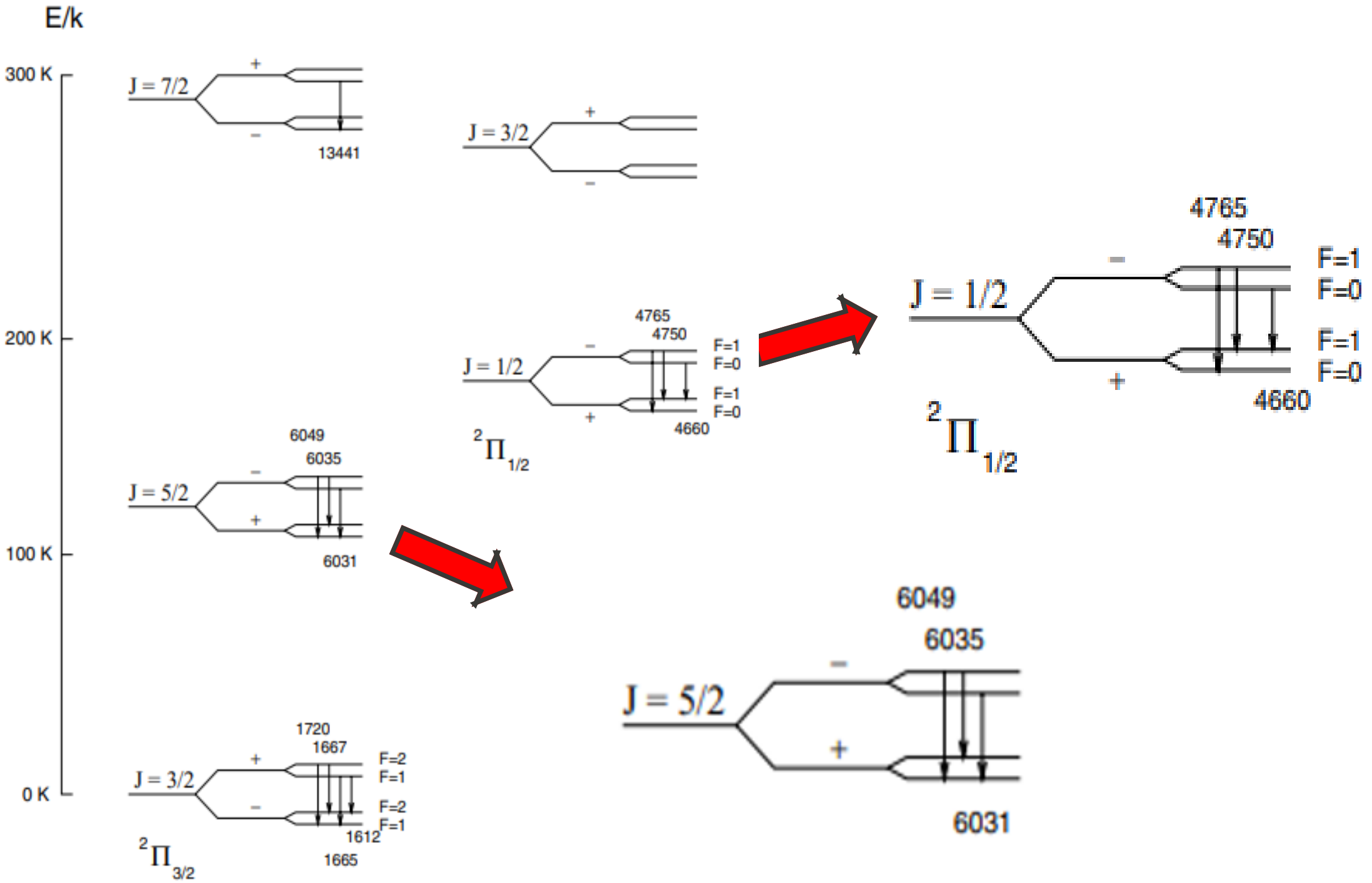
A Absorption

C Circular polarization

E Emission

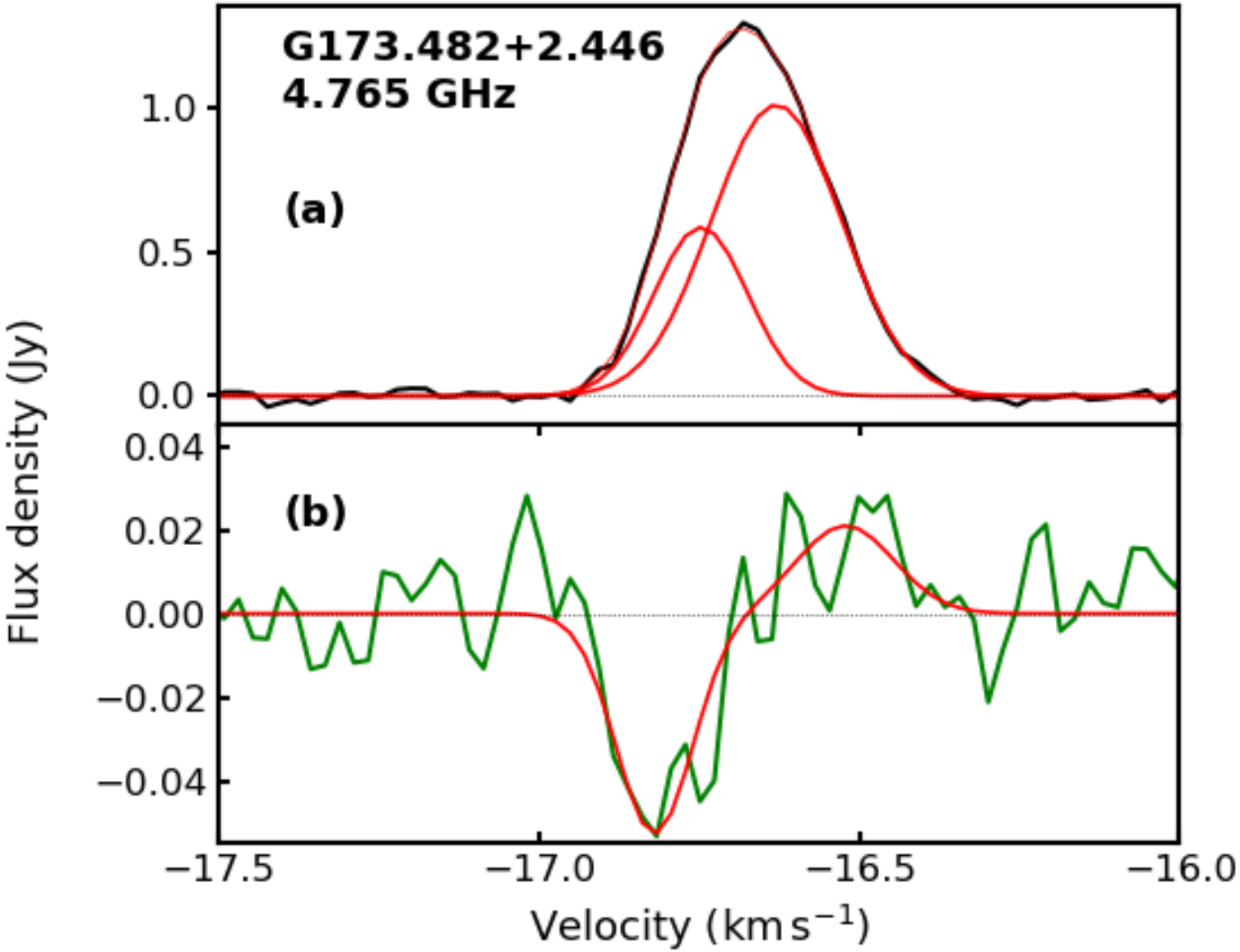
L Linear polarization

M Maser

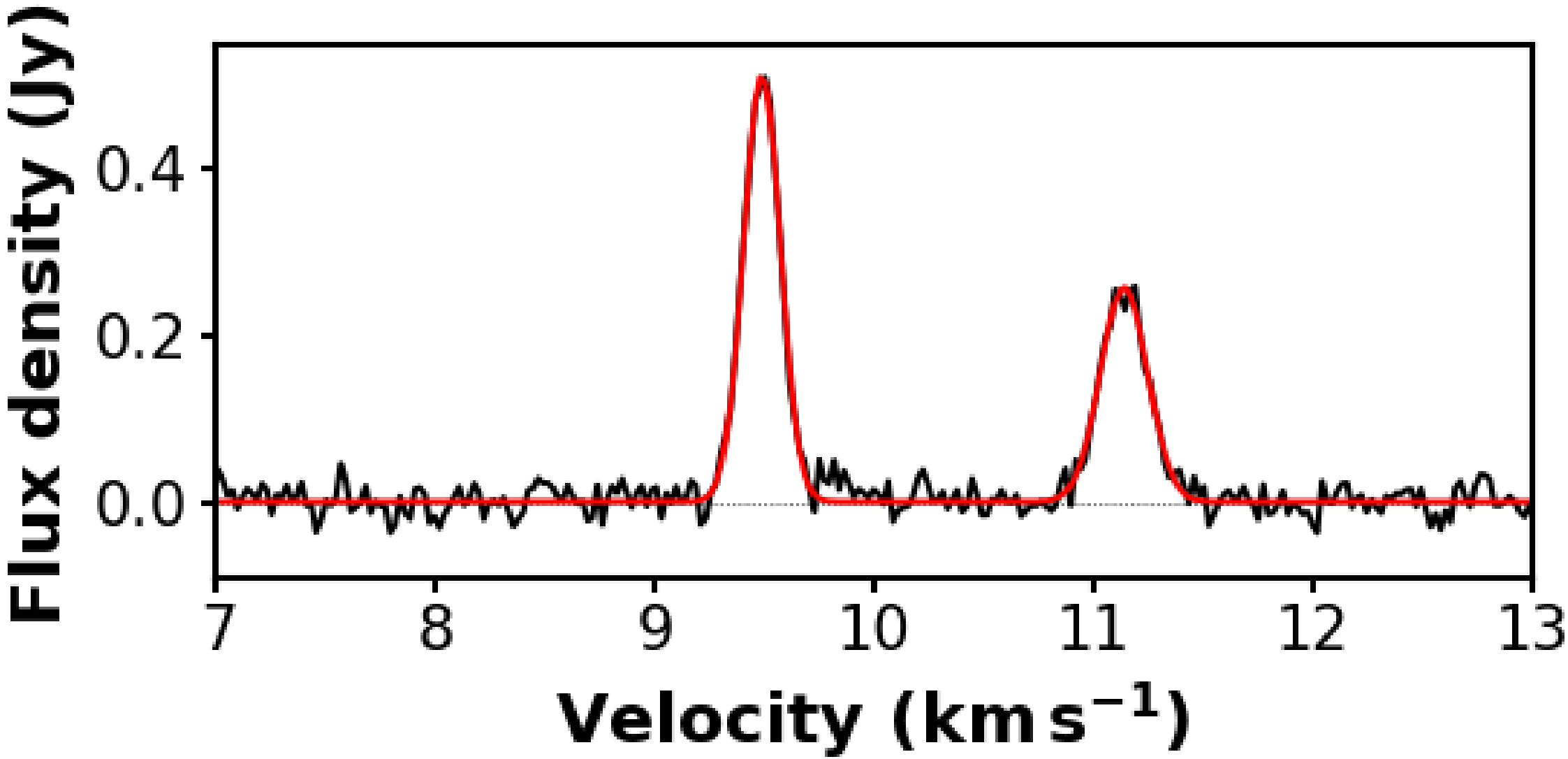

E/k
300 K
200 K
100 K
0 K
J = 7/2
13441
J = 3/2
J = 1/2
4765
4750
4660
F=1
F=0
F=1
F=0
$^2\Pi_{1/2}$
J = 5/2
6049
6035
6031
$^2\Pi_{3/2}$
1720
1667
1612
1665
F=2
F=1
F=2
F=1

4.7 GHz Results

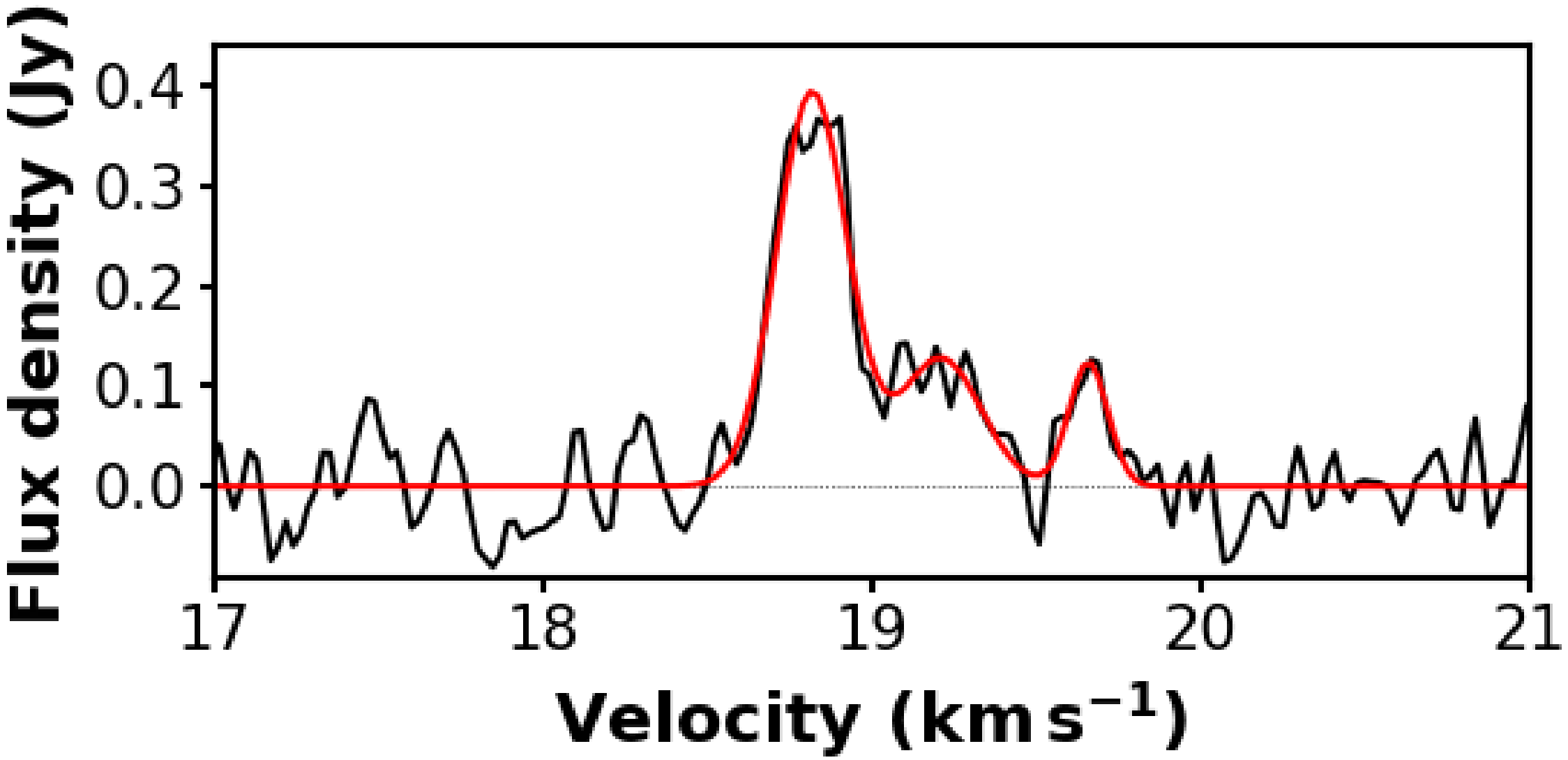
- No 4.660 or 4.750 GHz masers
- 3 new 4.765 GHz masers
- Circular polarization in 2 sources (reported last year)
- Linear polarization in 1 source only (known since 1995)
- Flaring in Mon R2 has reached new heights

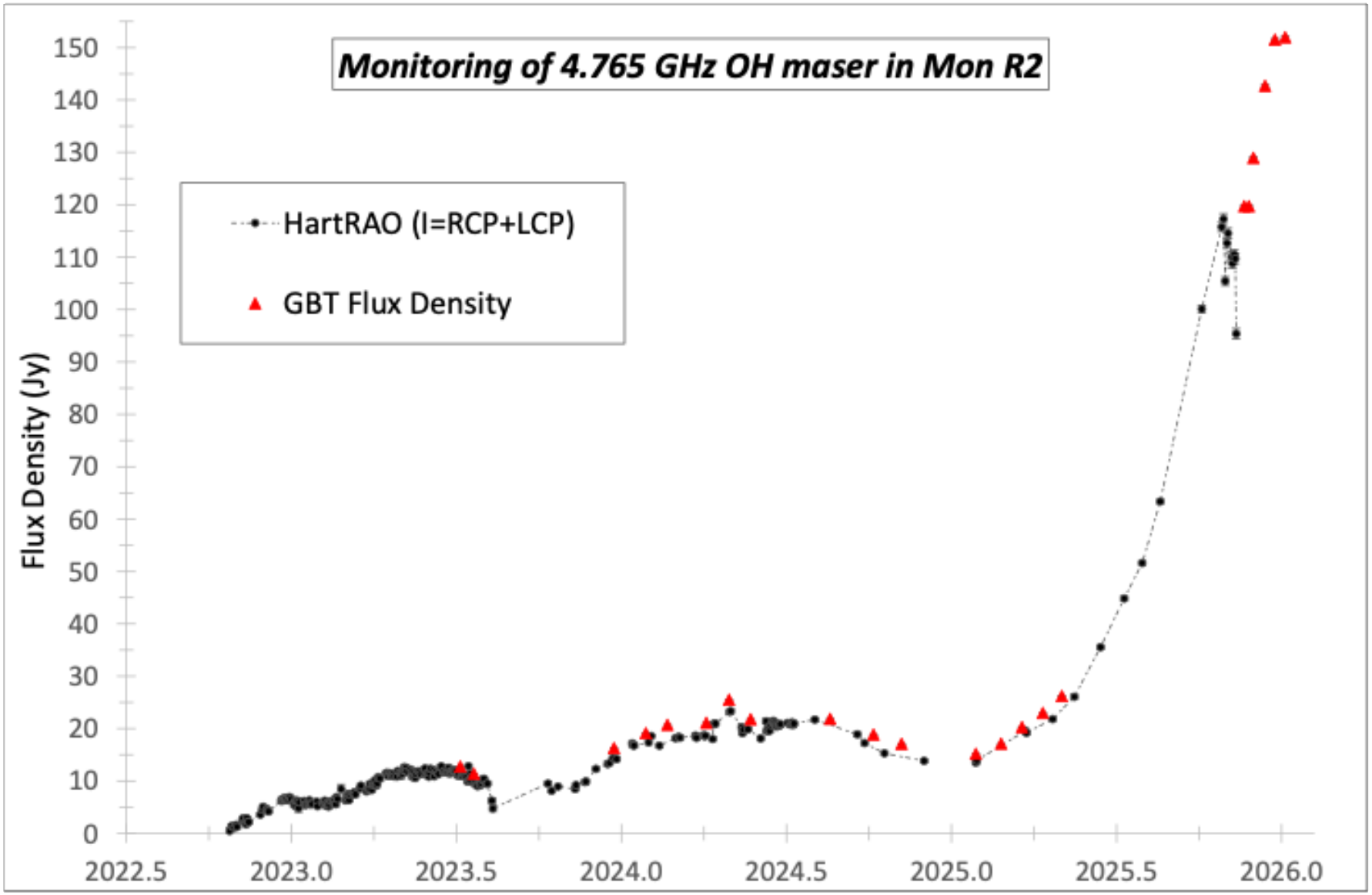

G173.482+2.446
4.765 GHz
(a)
(b)
1.0
0.5
0.0
0.04
0.02
0.00
−0.02
−0.04
−17.5
−17.0
−16.5
−16.0
Flux density (Jy)
Velocity (km s^{-1})

G188.946+0.886



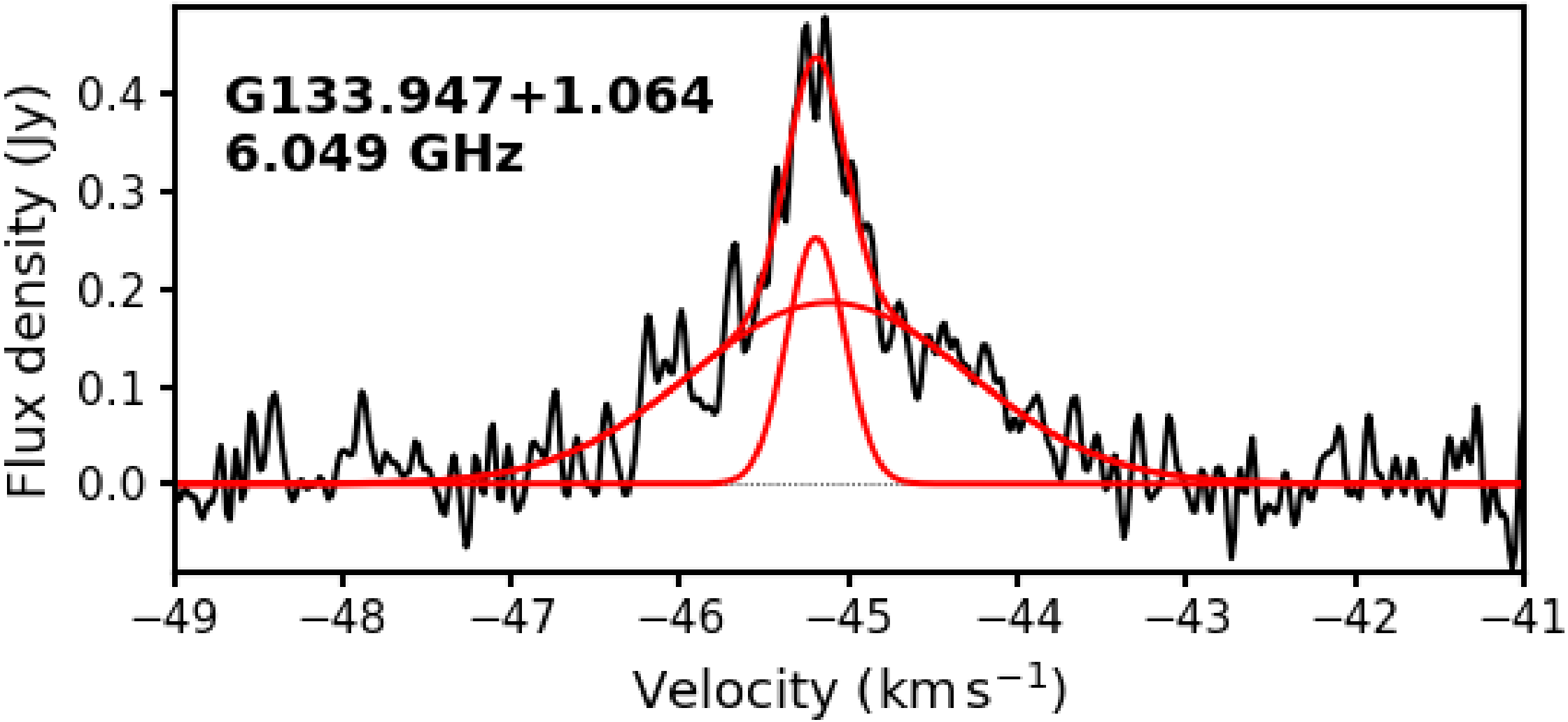
G196.454-1.667



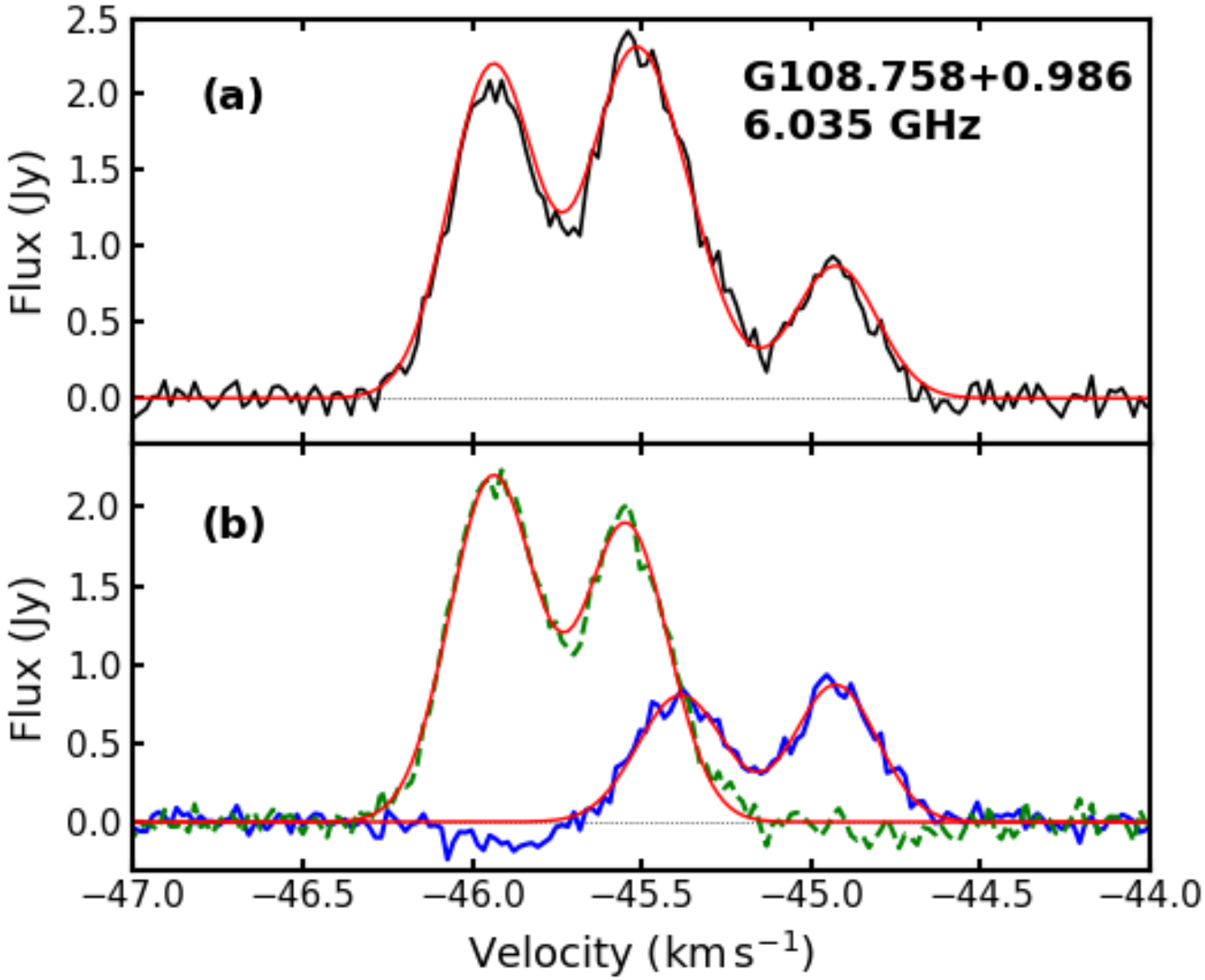

Monitoring of 4.765 GHz OH maser in Mon R2
HartRAO (I=RCP+LCP)
GBT Flux Density
Flux Density (Jy)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
2022.5
2023.0
2023.5
2024.0
2024.5
2025.0
2025.5
2026.0

6.0 GHz Results

- No 6.016 GHz masers
- 1 source with 6.049 GHz maser (only one known)
- Confirmed it is maser emission and have Gaussian parameters
- Thermal absorption seen in several sources

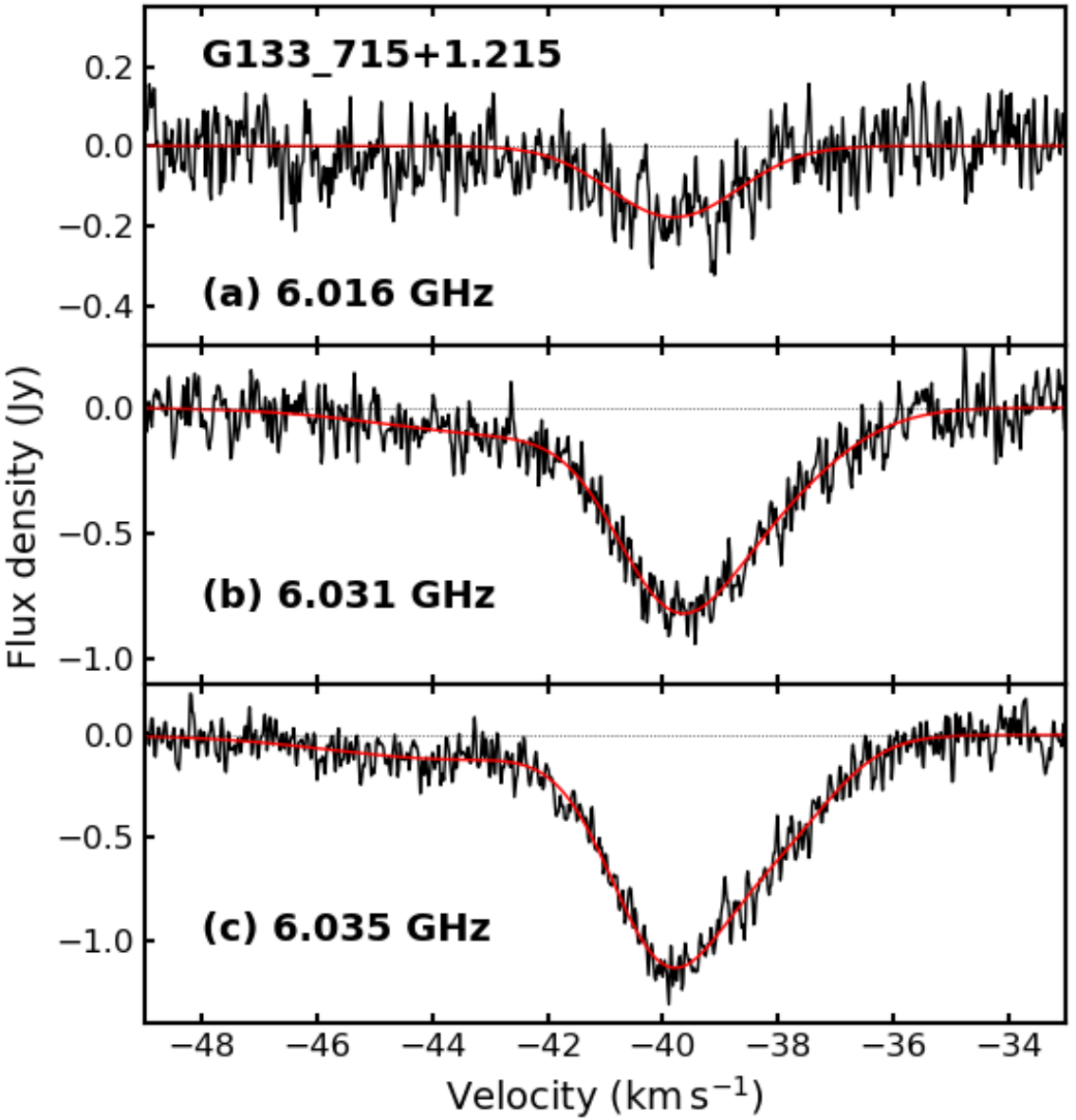

G133.947+1.064
6.049 GHz
Flux density (Jy)
0.4
0.3
0.2
0.1
0.0
−49
−48
−47
−46
−45
−44
−43
−42
−41
Velocity (km s^{-1})

- 100% circular polarization
- Magnetic fields of -9.8 and -10.9 mG
- Differ from other recent measurements suggesting changing magnetic fields



Thermal absorption

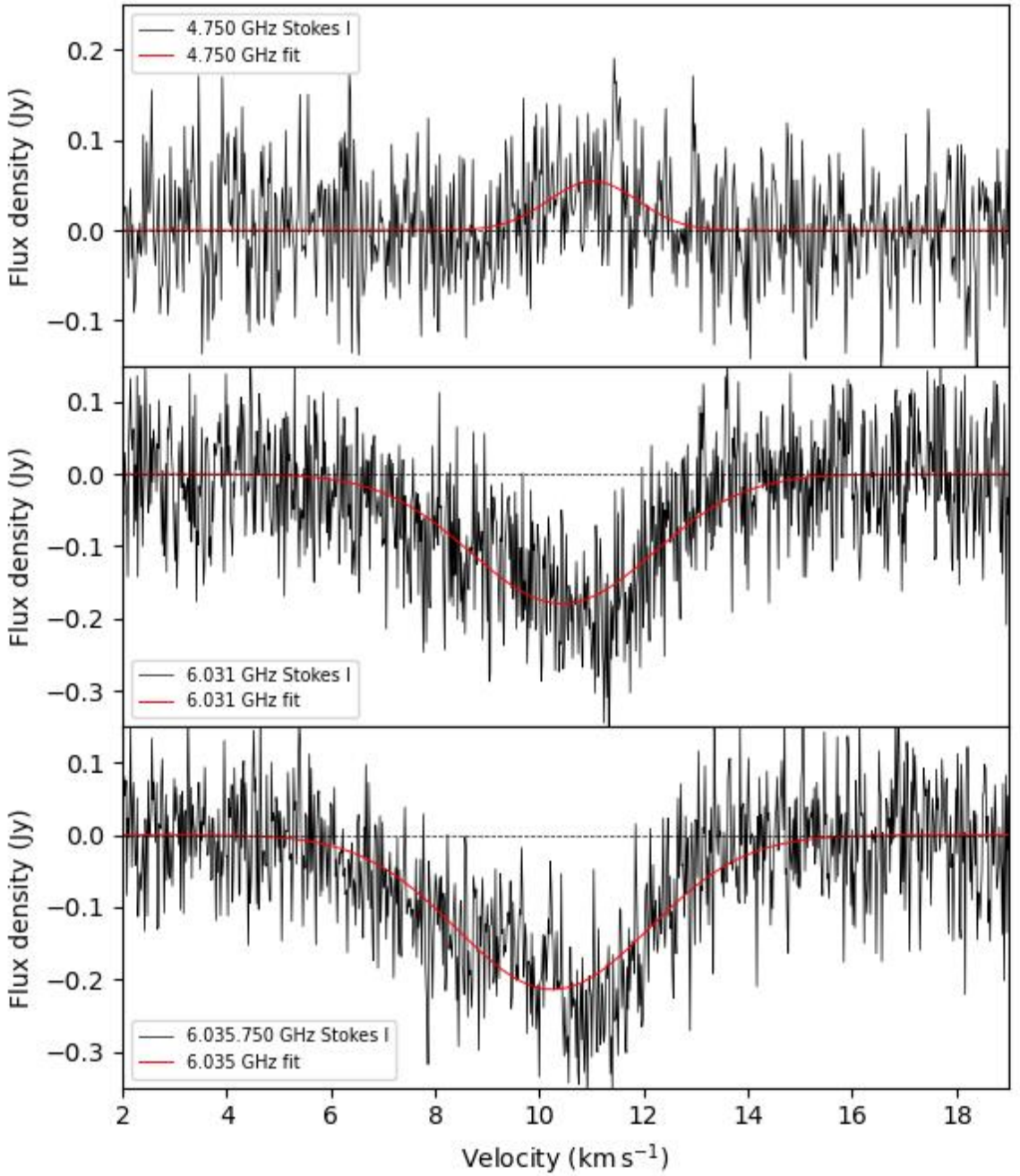
Asymmetrical line profiles suggests at least 2 sets of absorption lines at different velocities.



Mon R2

Thermal emission at 4.750 GHz

Thermal absorption at 6.031 and 6.035 GHz



Conclusion/Summary

- Important to have calibrated feeds so that the gain in RCP and LCP is the same, and no contribution from Stokes I.
- 3 new 4.765 GHz masers found
- Flaring in Mon R2 has doubled in peak flux density from flare in 1997 (see talk by P Fallon at 17:15 for polarization properties)
- 6.049 GHz maser also has thermal emission
- Thermal emission and absorption found in G133.715 and Mon R2
- Zeeman pairs found in some 6.035 GHz masers which provides a measure of the magnetic field in these regions