The PRIMOS Project
Seven Years of Astronomical Discovery

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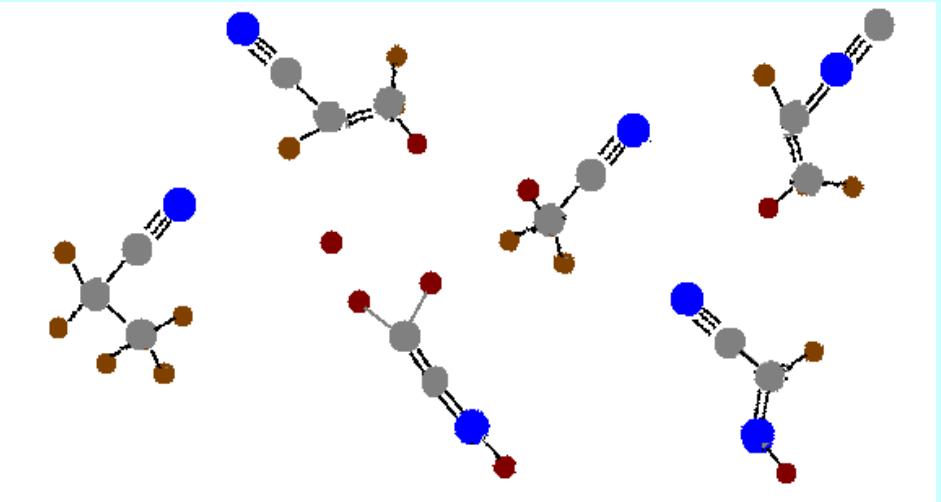
University of Virginia Astronomy



Brett McGuire	California Institute of Technology
Mike Hollis	NASA Goddard
Frank Lovas	National Institute of Science & Technology
Philip Jewell	National Radio Astronomy Observatory
Anthony Remijan	National Radio Astronomy Observatory

PRIMOS

PRebiotic Interstellar MOlecular Survey

– A Key Science Project with the GBT

(Hollis et al. 2007)

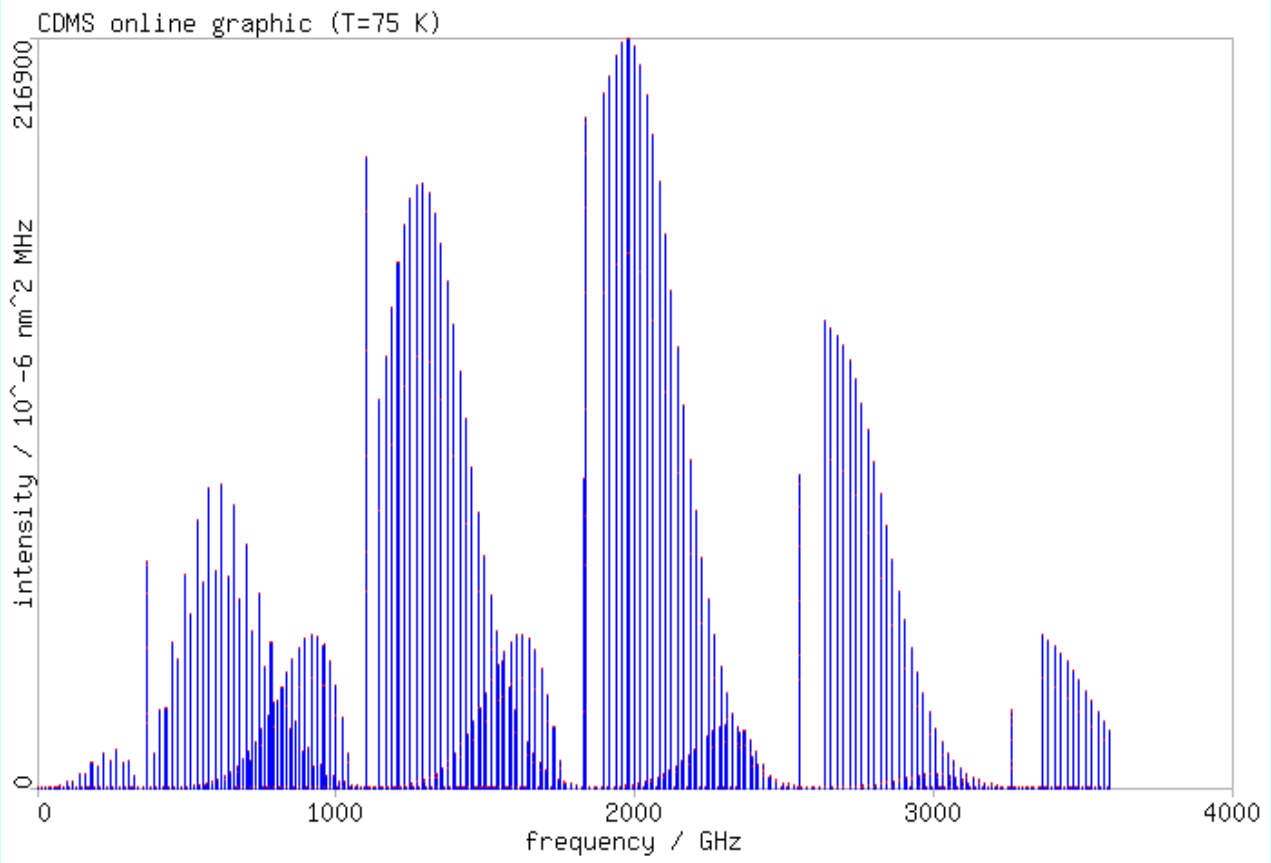
Towards Sgr B2(N).

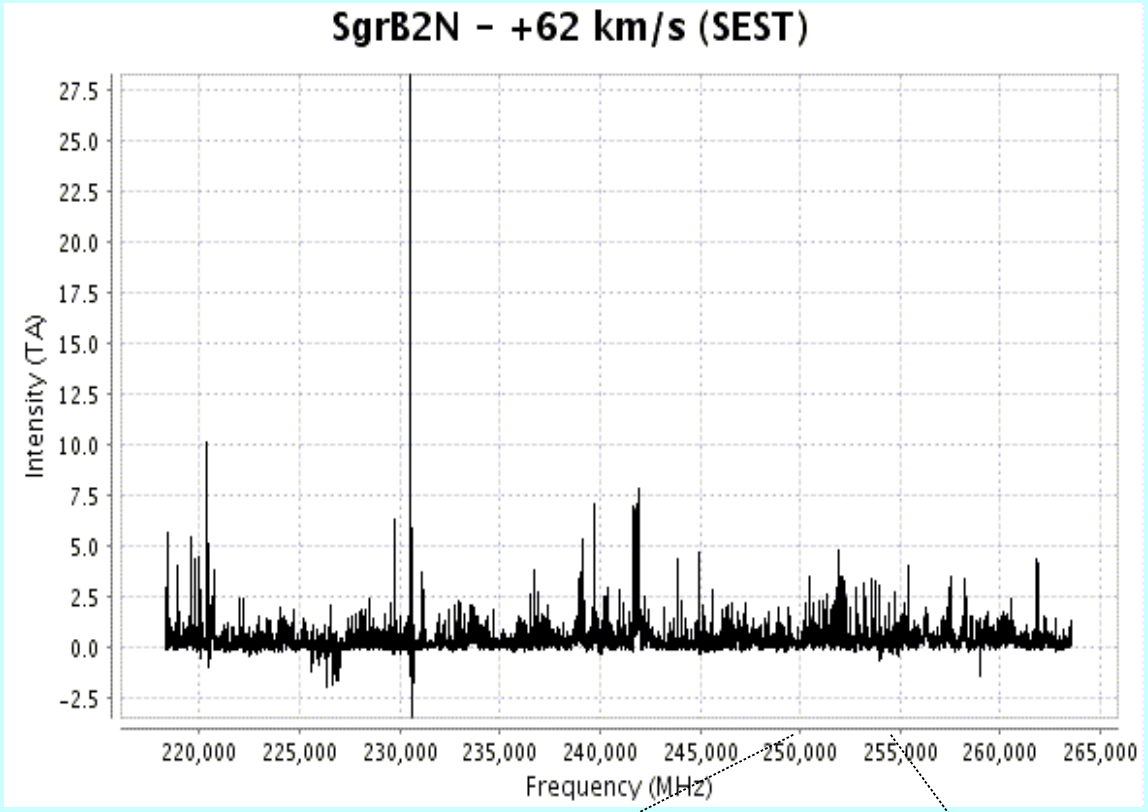
The deepest, most frequency complete centimeter wave survey.

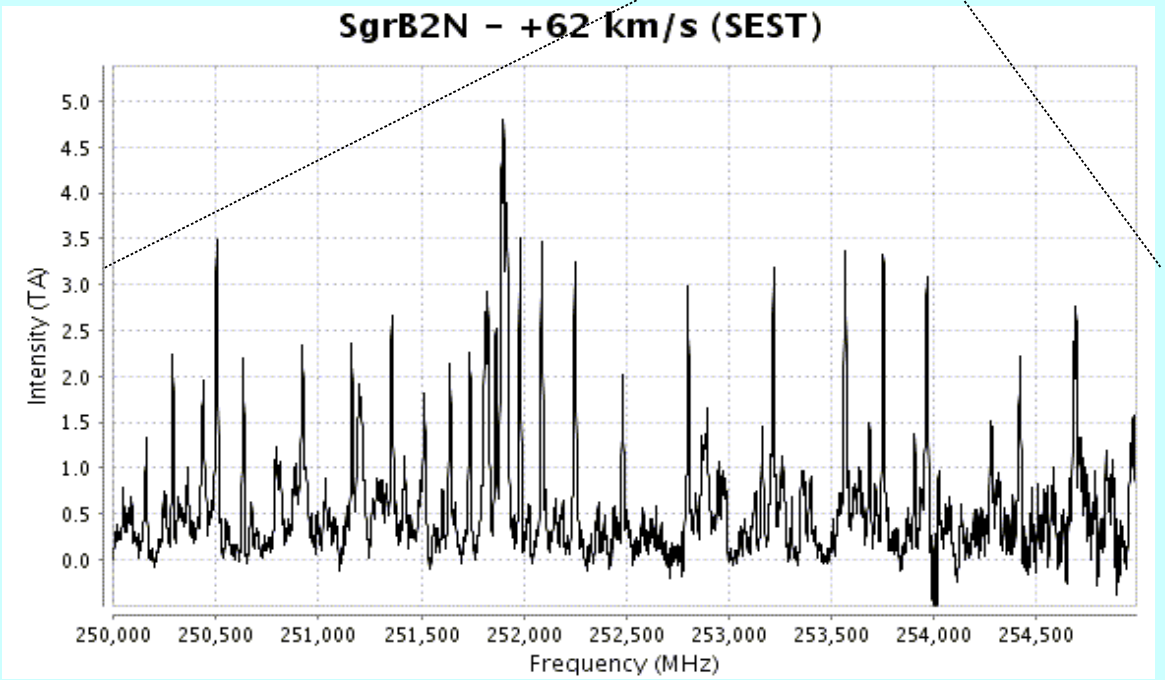
1 – 50 GHz present, 50 – 92 GHz coming!

Interstellar Spectroscopy at Centimeter Wavelengths

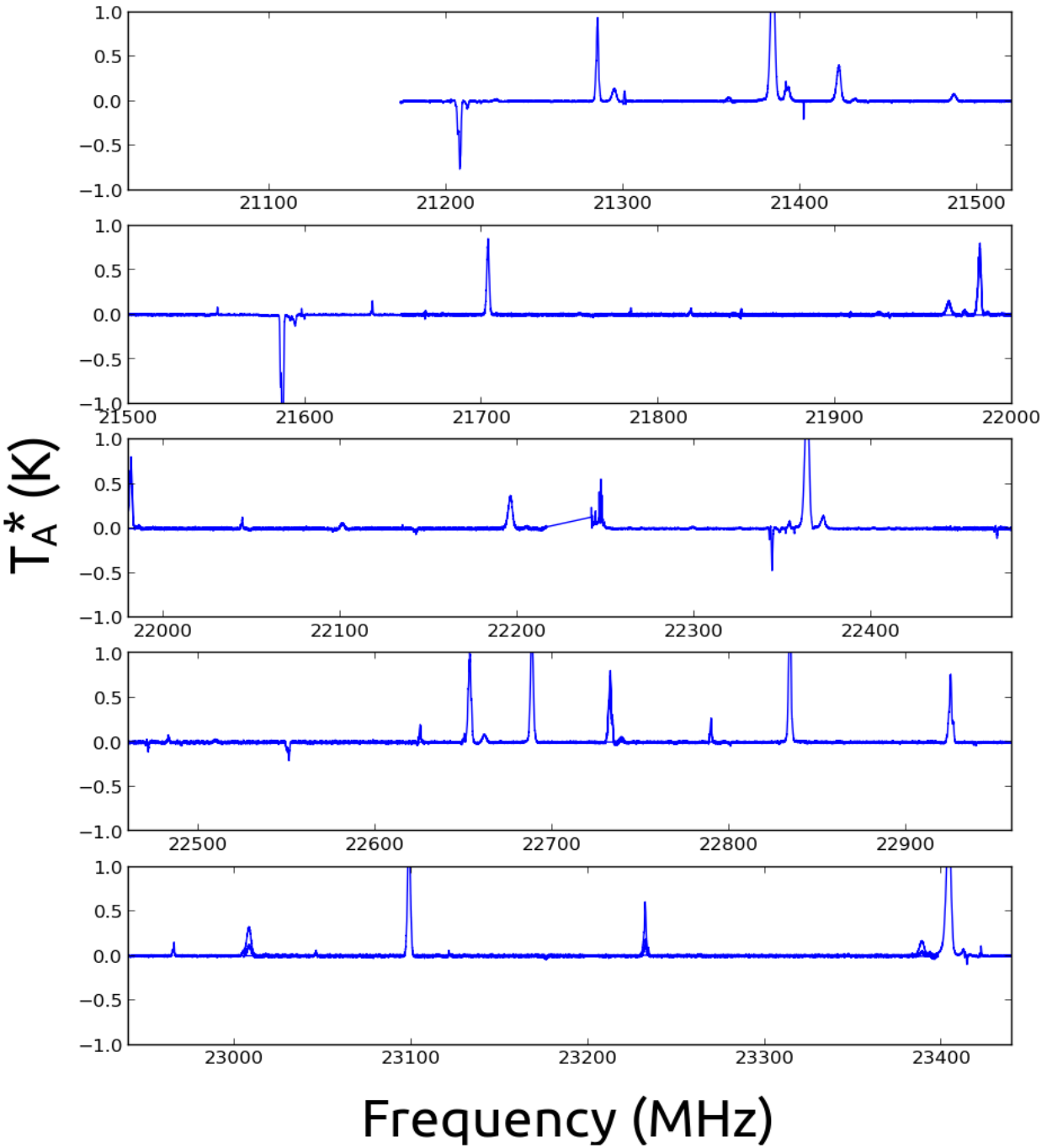
Why look in centimeter?

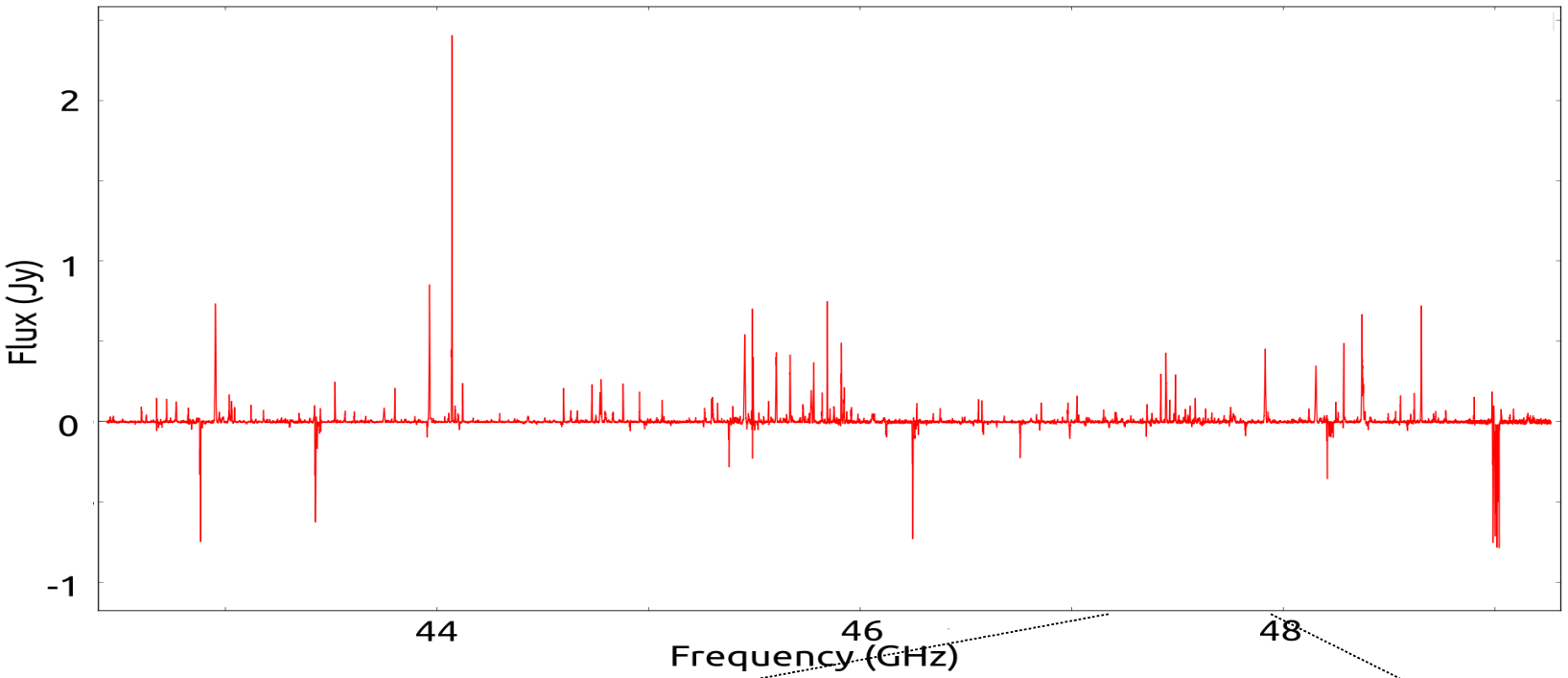


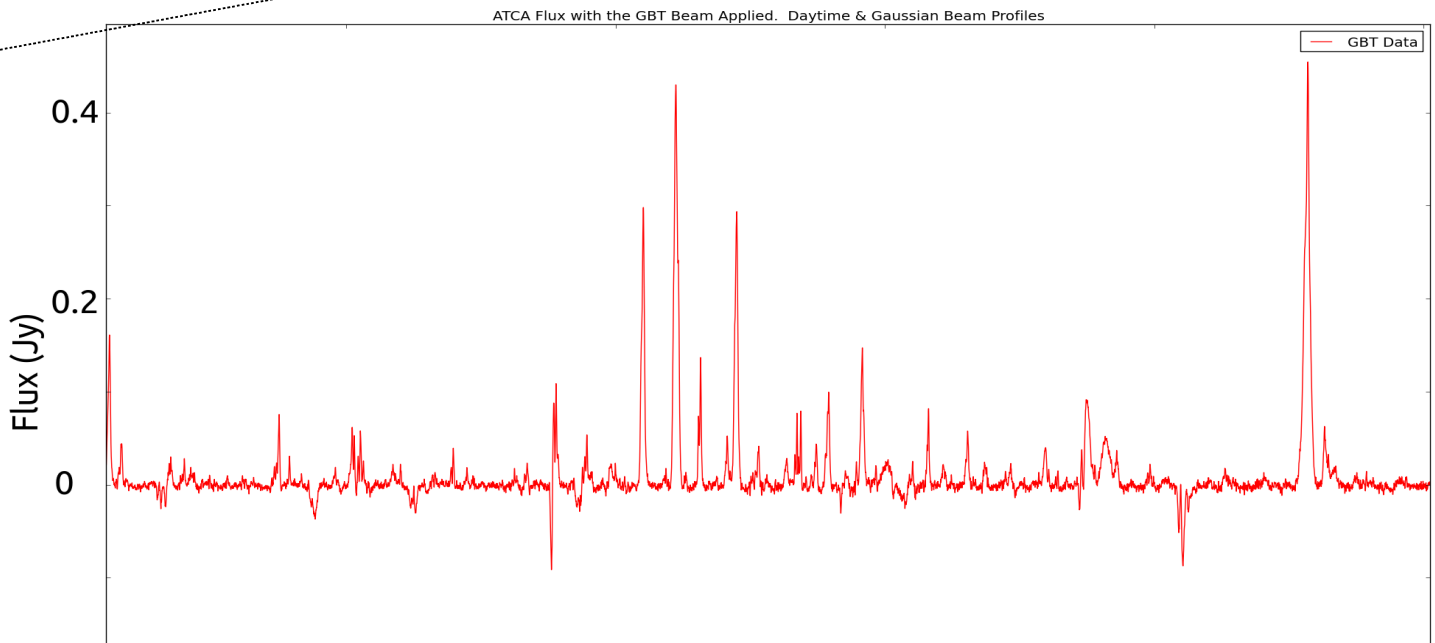

SgrB2N – +62 km/s (SEST)
Intensity (TA)
27.5
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
-2.5
220,000
225,000
230,000
235,000
240,000
245,000
250,000
255,000
260,000
265,000
Frequency (MHz)


SgrB2N – +62 km/s (SEST)
Intensity (TA)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
250,000
250,500
251,000
251,500
252,000
252,500
253,000
253,500
254,000
254,500
Frequency (MHz)

We see the noise floor

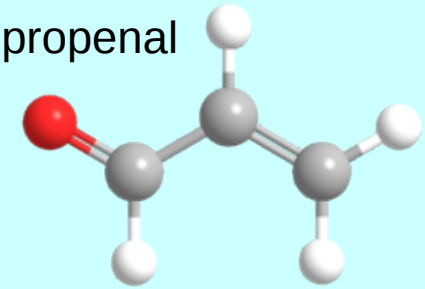


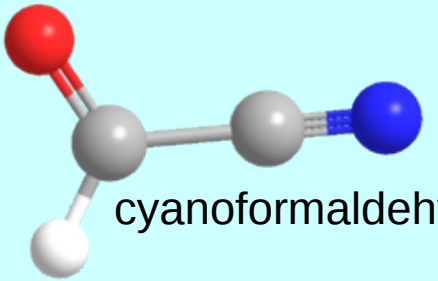

2
1
0
-1
Flux (Jy)
44
46
48
Frequency (GHz)


ATCA Flux with the GBT Beam Applied. Daytime & Gaussian Beam Profiles
GBT Data
0.4
0.2
0
Flux (Jy)

(Some) New Molecule Detections

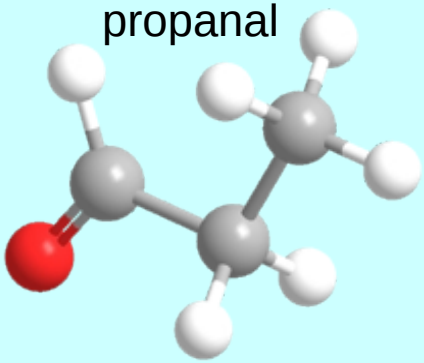
propenal

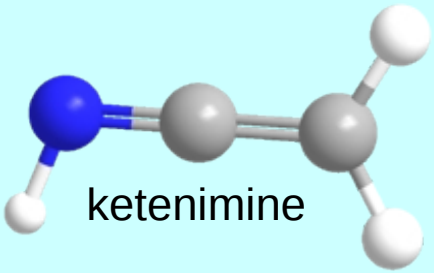




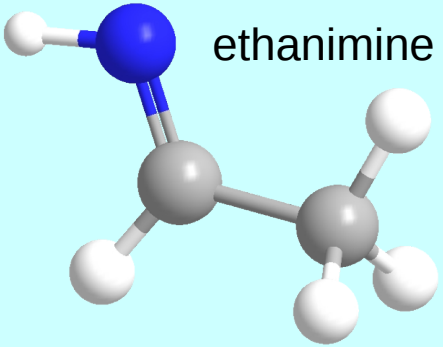
cyanoformaldehyde

propanal

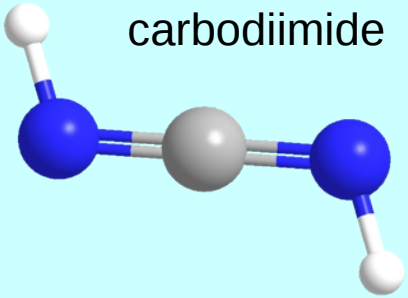




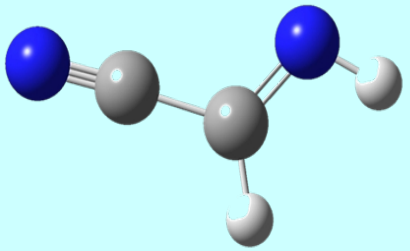
ketenimine



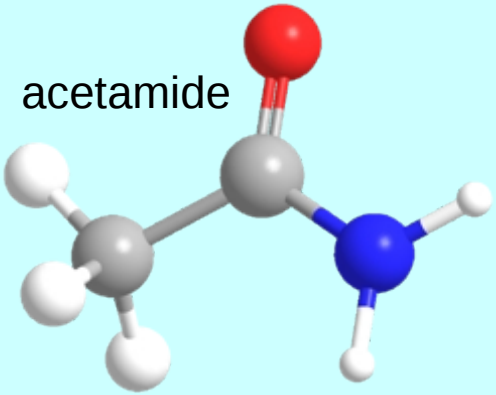
ethanimine



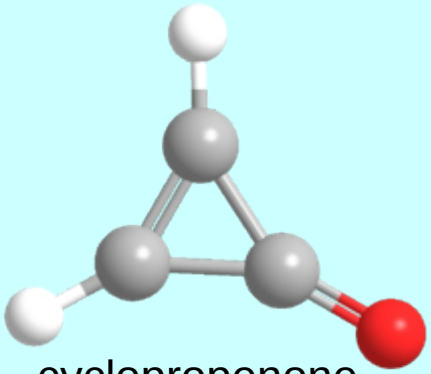
carbodiimide



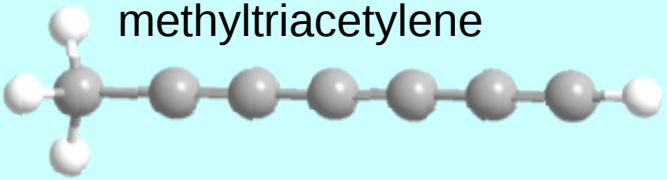
cyanomethanimine



acetamide

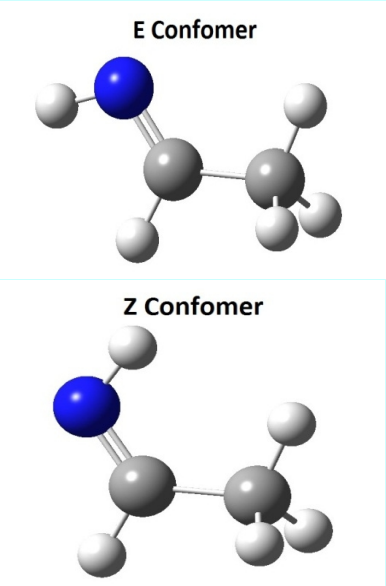


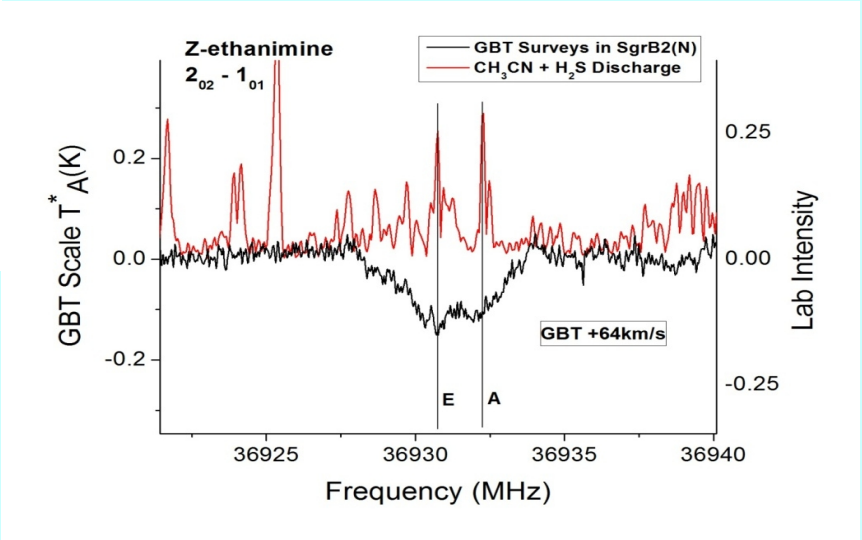
cyclopropenone



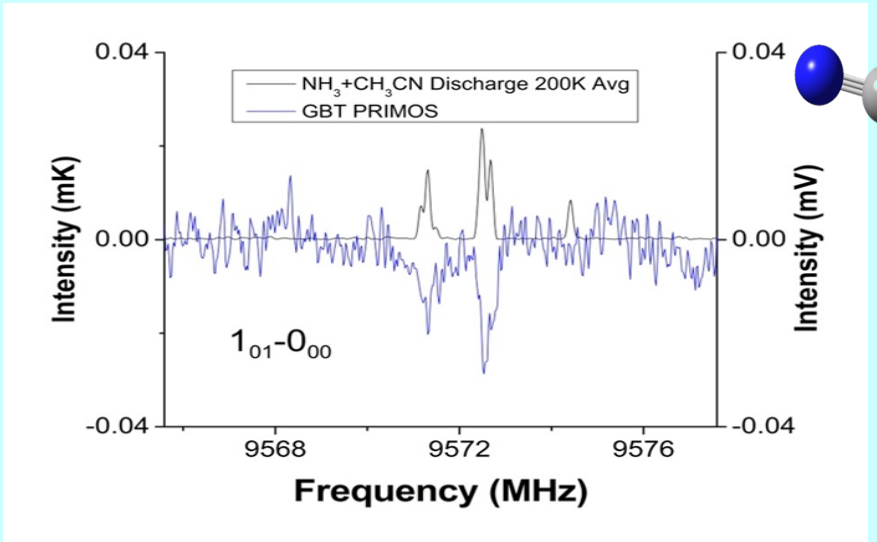
methyltriacetylene

Direct Comparison to Lab Spectroscopy
Highlighting New Detections



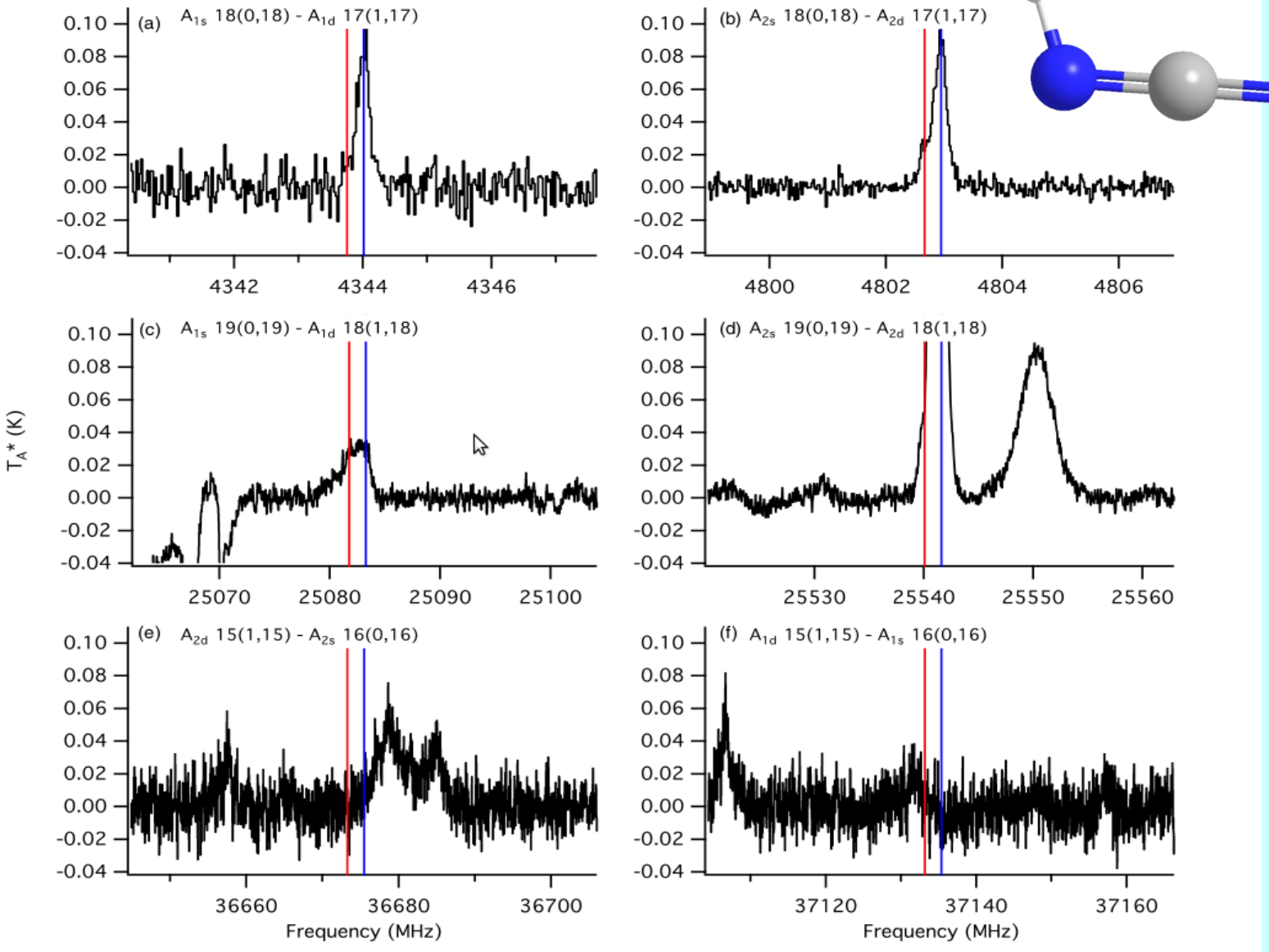


Loomis, et al. 2013, ApJL, 765, L10



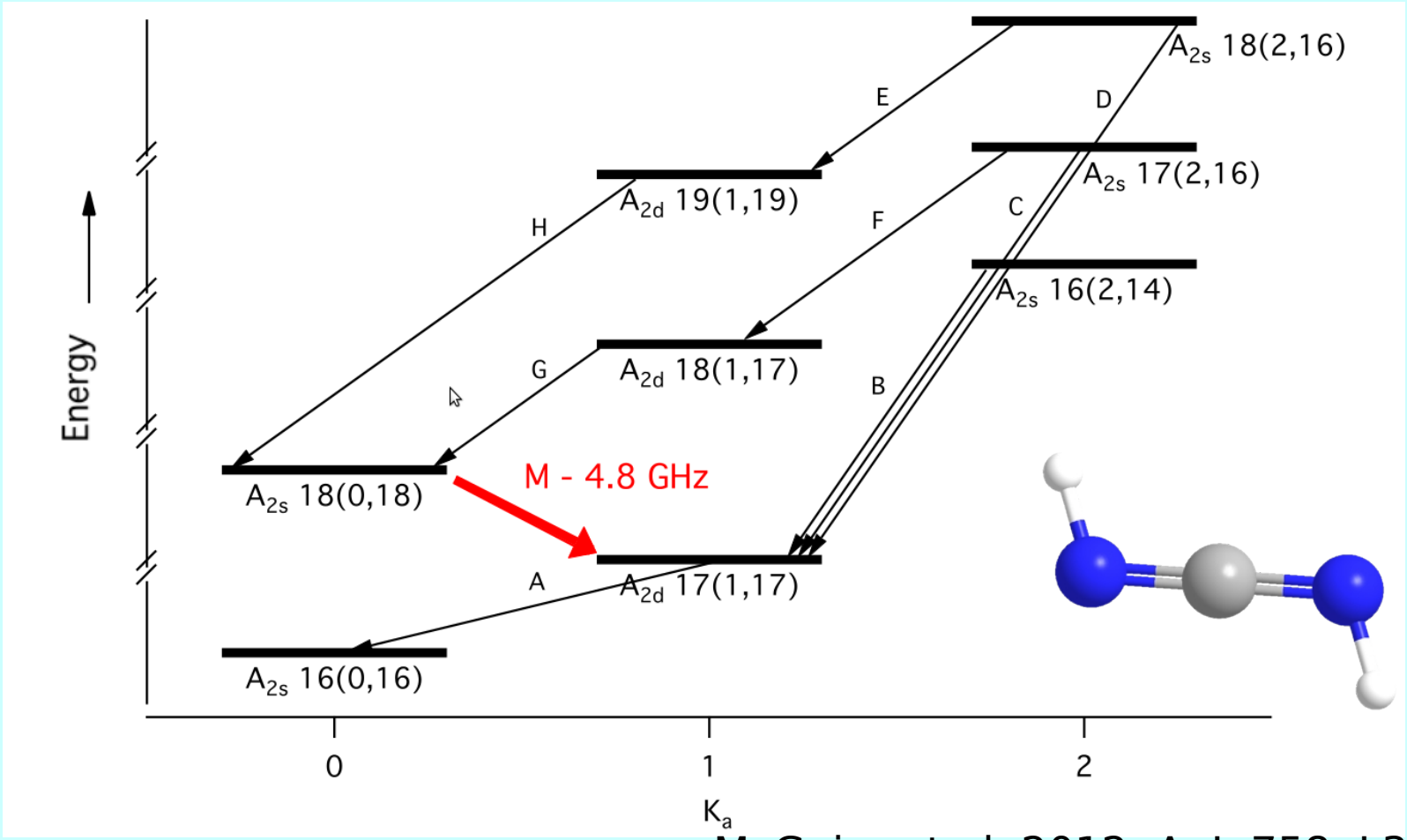
Zaleski et al. 2013 ApJ, 765, L9

Weakly Masing Transitions Carbodiimide



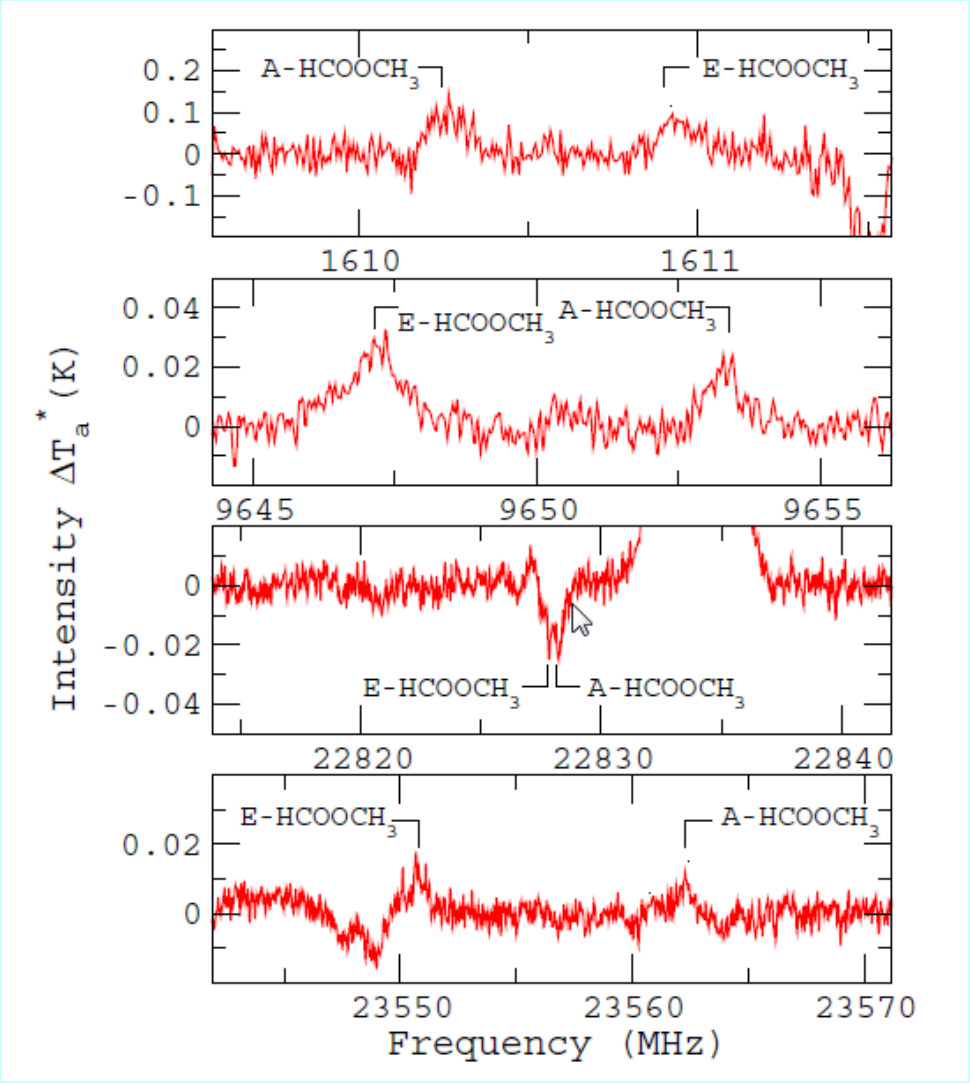
McGuire et al. 2012, ApJ, 758, L33

Weakly Masing Transitions
Carbodiimide



McGuire et al. 2012, ApJ, 758, L33

Weakly Masing Transitions
Methyl Formate



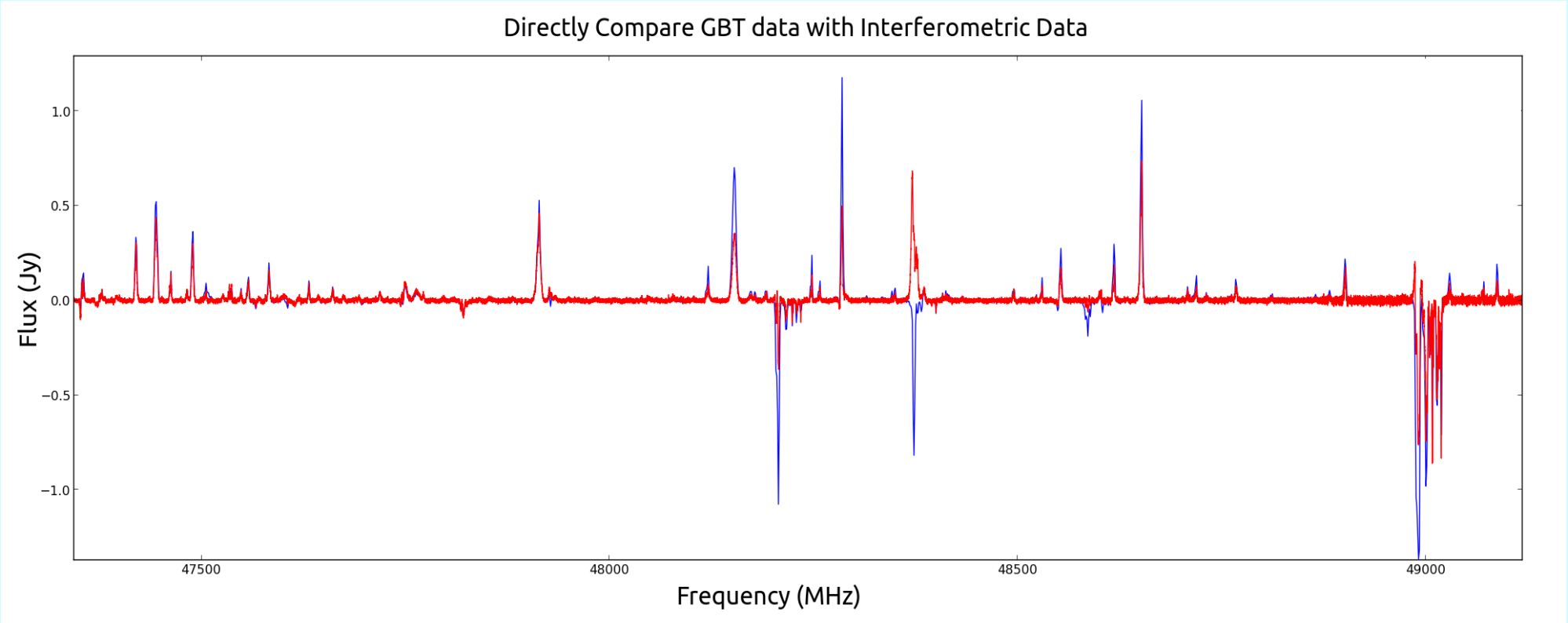
The conclusion is that *all detected* methyl formate lines below 30 GHz are masers!

Q. What mechanisms are pumping these new masers?
A. Can mapping the distribution give insight to excitation and possible formation?

Faure et al. 2014, ApJ, 783, 72F

PRIMOS & Broadband Interferometry

Direct comparisons at centimeter wavelengths



PRIMOS & ALMA

Need both cm & mm to compile molecular inventories.

Non-LTE effects important for interpreting results.

Can sample different physical environments.