Star Formation Newsletter #266
No. 11-16,　花輪 知幸

11. Detection of glycolaldehyde towards the solar-type protostar NGC1333 IRAS2A, Coutens et al.

12. 6.7GHz Methanol Maser Associated Outflows: An evolutionary sequence, Villiers

13. Non-LTE Modelling of the Structure and Spectra of the Hot Accretion Spots on the Surface of Young Stars, Dodin

14. An Optical Spectroscopic Survey of the Serpens Main Cluster: Evidence for Two Populations? Ericsson et al.

15. Complex organic molecules in organic-poor massive young stellar objects, Fayolle et al.

Detection of glycolaldehyde towards the solar-type protostar NGC 1333 IRAS2A

A. Coutens et al. A&Ap

Glycoaldehyde = CH_2OHCHO, NGC 1333 IRAS2A hot coring protostar class 0 (d = 200 pc)

Molecule	Source size (″)	T_{ex} (K)	N (cm^{-2})	v_{LSR} ($km\,s^{-1}$)
CH_2OHCHO	0.5	130	2.4×10^{15}	7.0
aGg′-$(CH_2OH)_2$	0.5	130	1.1×10^{16}	7.0
CH_3OCHO	0.5	130	4.8×10^{16}	7.0

Ethylene Glycoal = $(CH_2OH)_2$

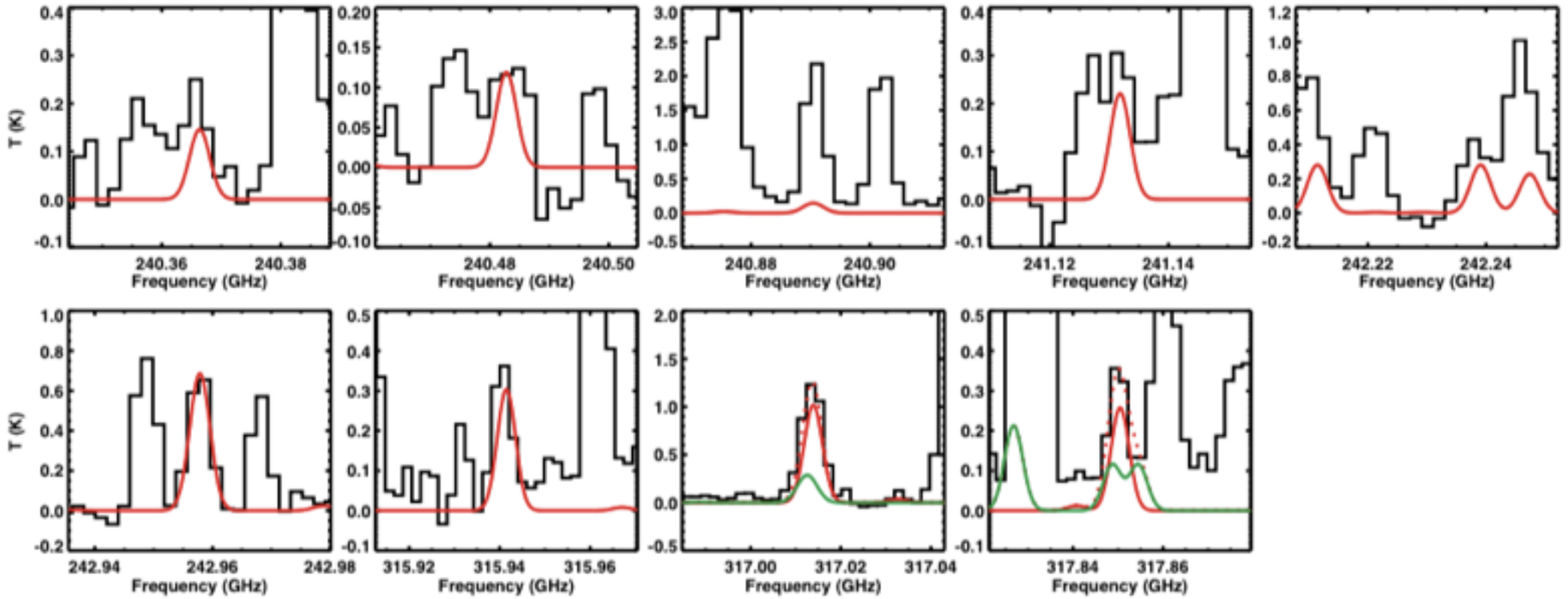
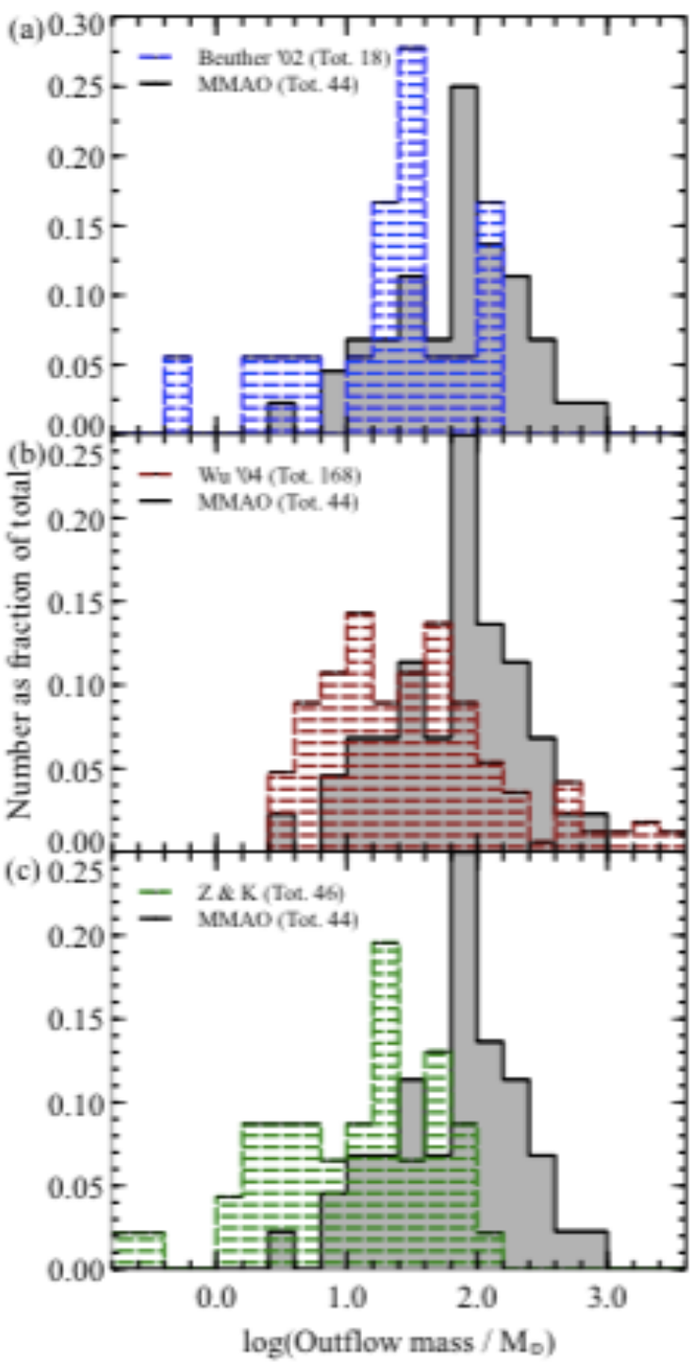
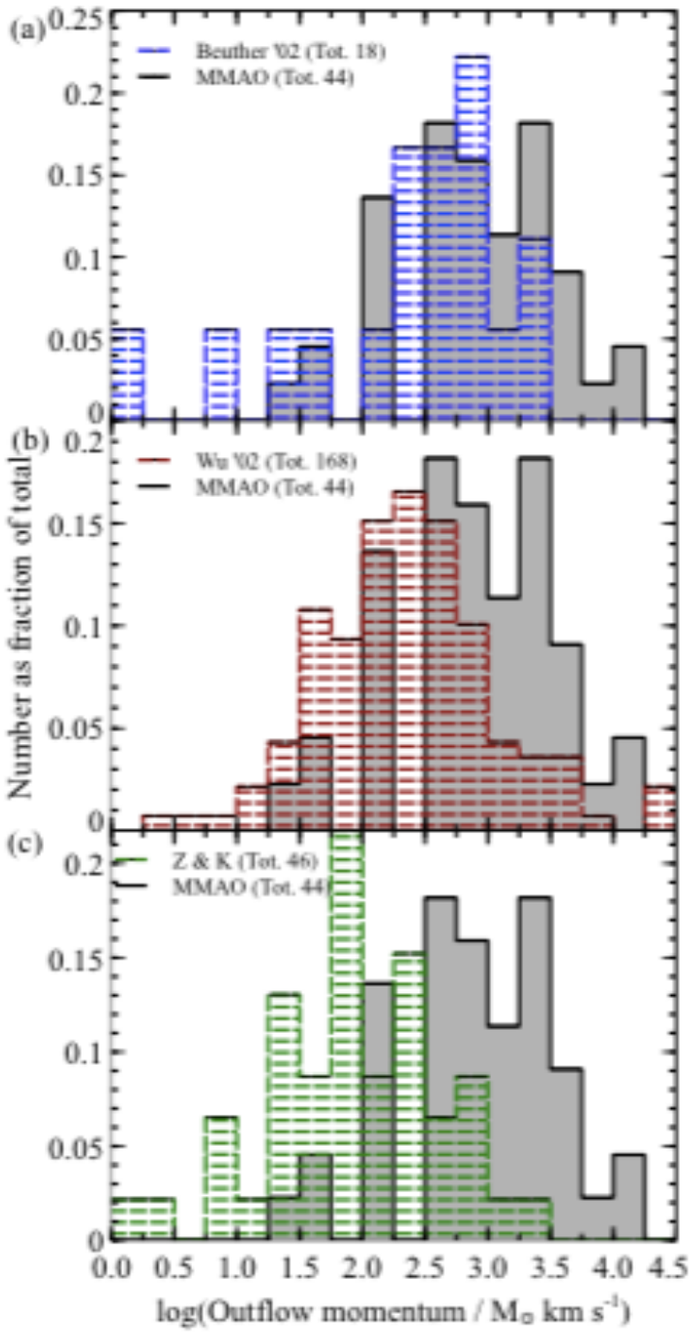


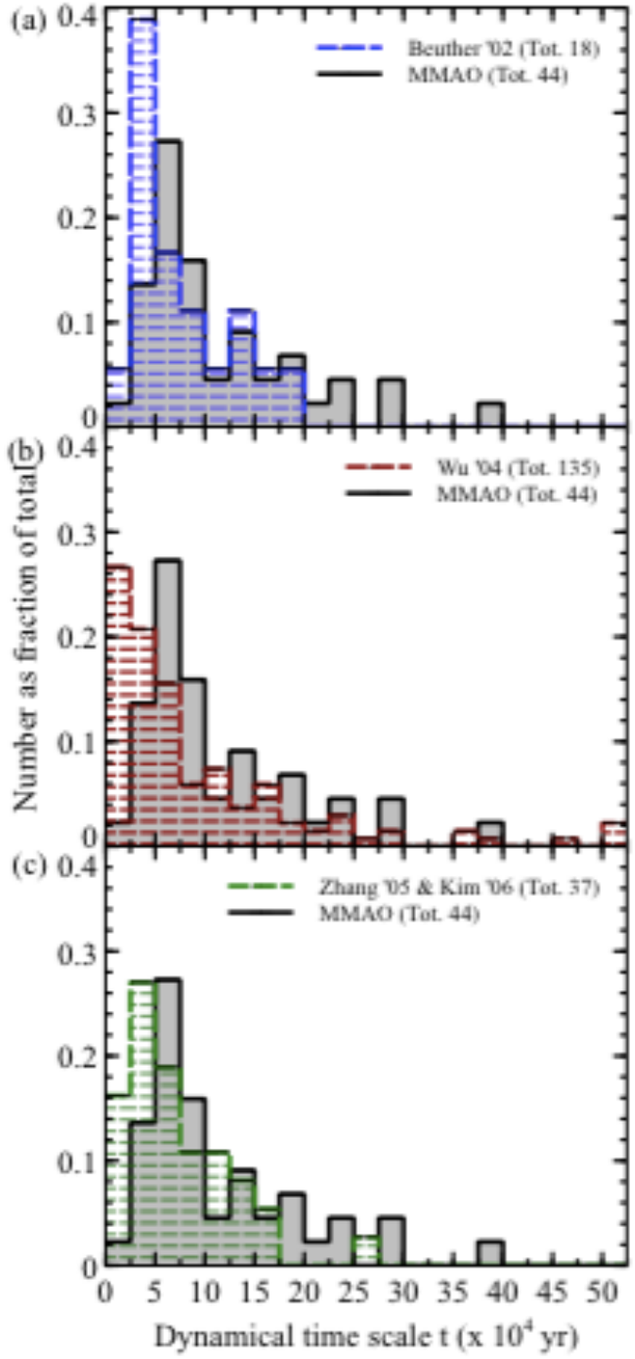
Fig. 2. Observed lines of CH_2OHCHO towards the protostar NGC 1333 IRAS2A (in black). The best-fit model for CH_2OHCHO (see Table 2) is shown in red solid lines. The line in the third upper panel is blended with an unidentified species. The contribution of the CH_3OCHO lines is indicated with green lines, and the model including both CH_2OHCHO and CH_3OCHO can be seen in red dotted lines.

Source	$(CH_2OH)_2/CH_2OHCHO^a$	CH_3OCHO/CH_2OHCHO	$CH_3OCHO/(CH_2OH)_2{}^a$	References
		Class 0 protostars		
NGC 1333 IRAS2A	~5	~20	~4	1
IRAS 16293-2422	~1	~13	~13	2
		Comets		
C/1995 O1 (Hale-Bopp)	≥ 6	≥ 2	~ 0.3	3
C/2012 F6 (Lemmon)	≥ 3	...	≤ 0.7	4
C/2013 R1 (Lovejoy)	≥ 5	...	≤ 0.6	4
		High– and intermediate–mass star forming regions		
Sgr B2(N)	0.7–2.2[b]	~52[c]	~30	5, 6, 7
G34.41+0.31	...	≤ 34	...	8
NGC7129 FIRS2	~2	~40	~20	9
		Molecular clouds in the Central Molecular Zone		
G–0.02, G–0.11, and G+0.693	~1.2–1.6	~3.3–5.2	~2.5–4.3	10

6.7GHz Methanol Maser Associated Outflows: An evolutionary sequence, de Villiers et al. MNRaS







分布の差はselection bias

Maser放射が後で始まる

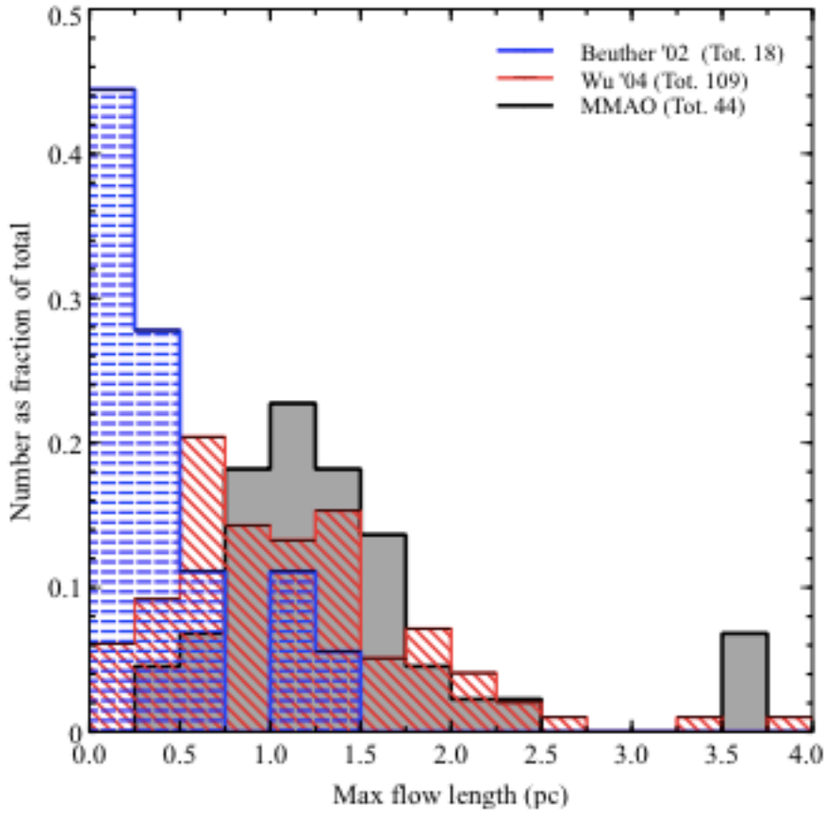


Figure 5. Distributions of the maximum outflow length for MMAOs (shaded area), Beuther et al. (2002a, blue horizontal lines), and Wu et al. (2004, red diagonal lines).

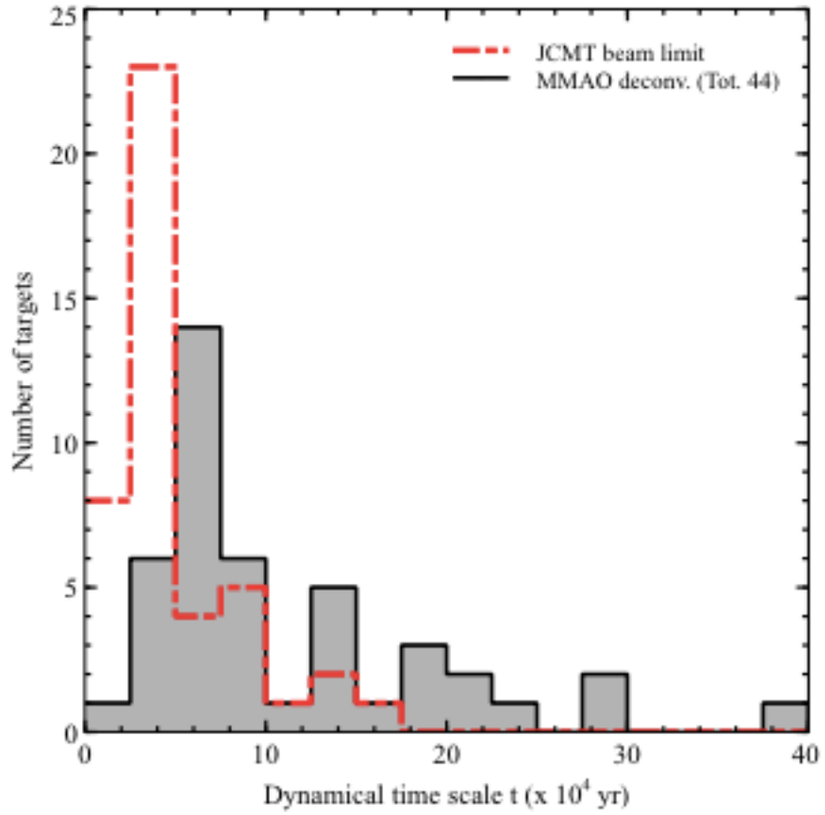


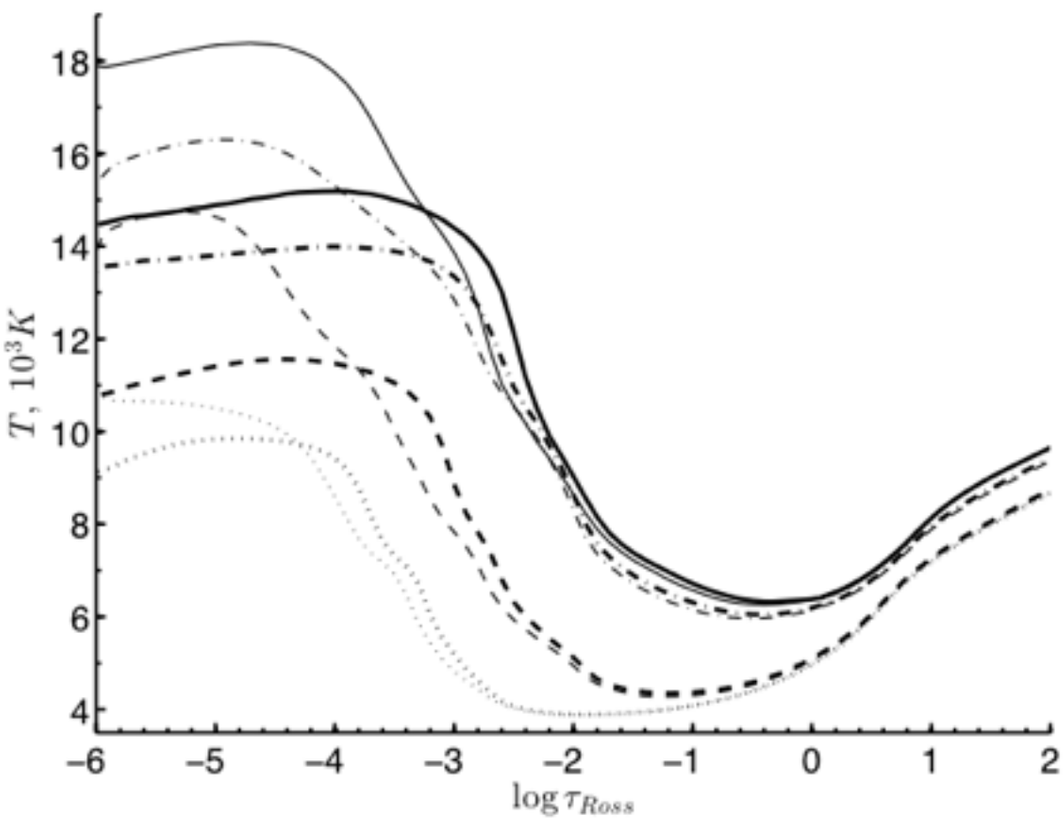
Figure 6. Distributions of the dynamical timescales for MMAOs after beam deconvolution (shaded area), and if every target only had a minimum lobe size of the $14''$ JCMT beam (red dashed line).

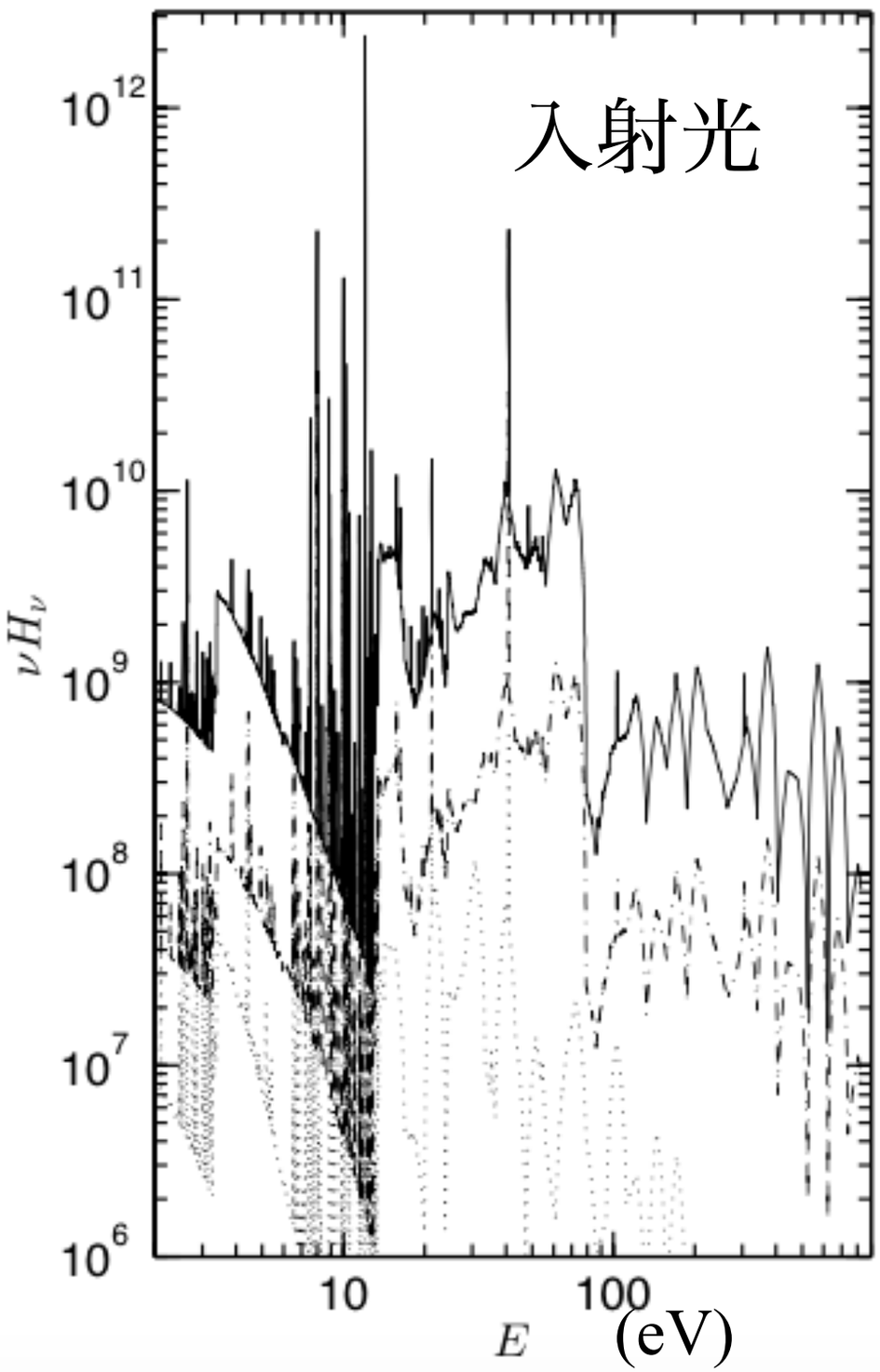
Non-LTE Modelling of the Structure and Spectra of the Hot Accretion Spots on the Surface of Young Stars,

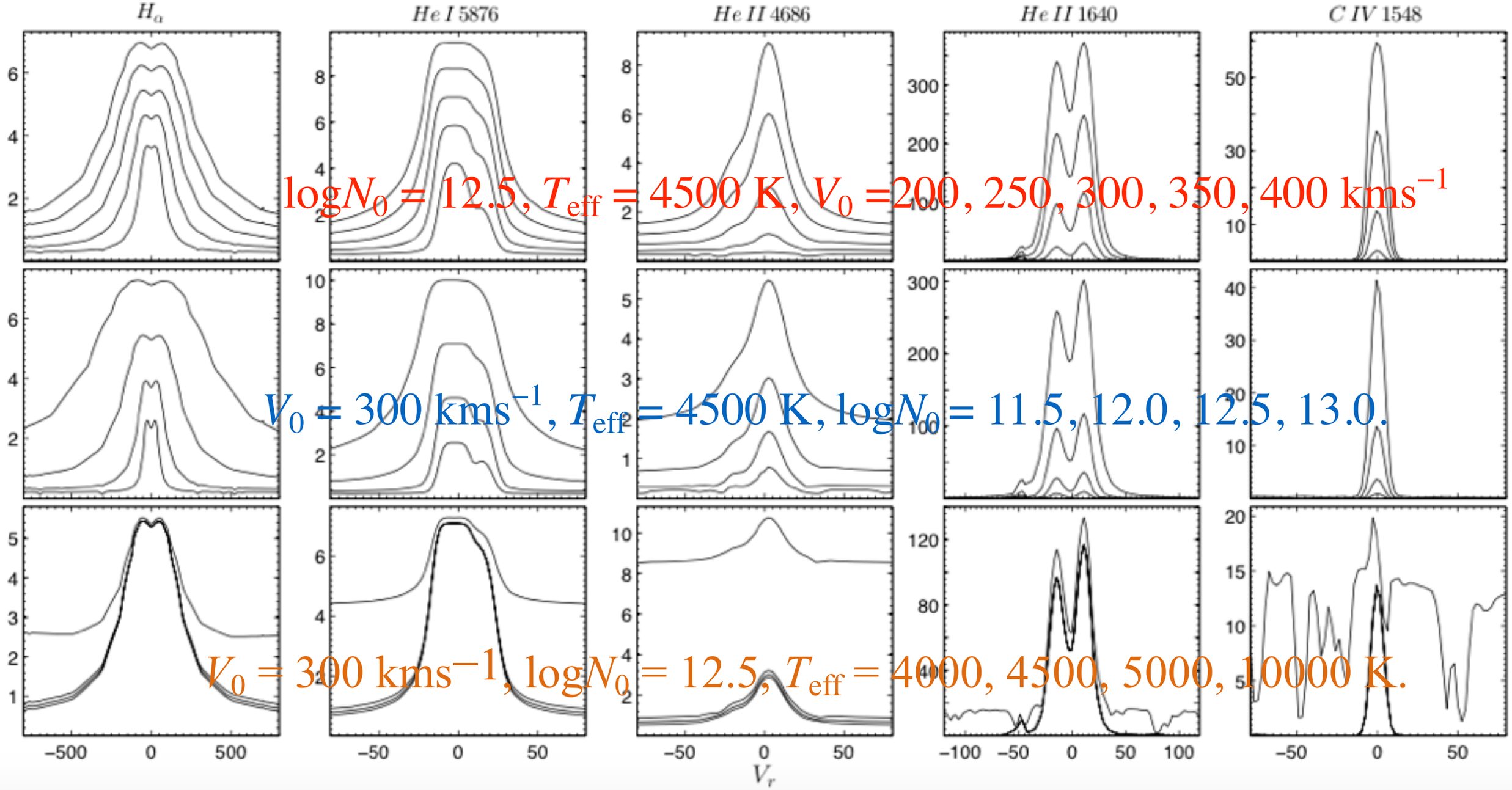
Dodin, Astronomy Letters

モデル

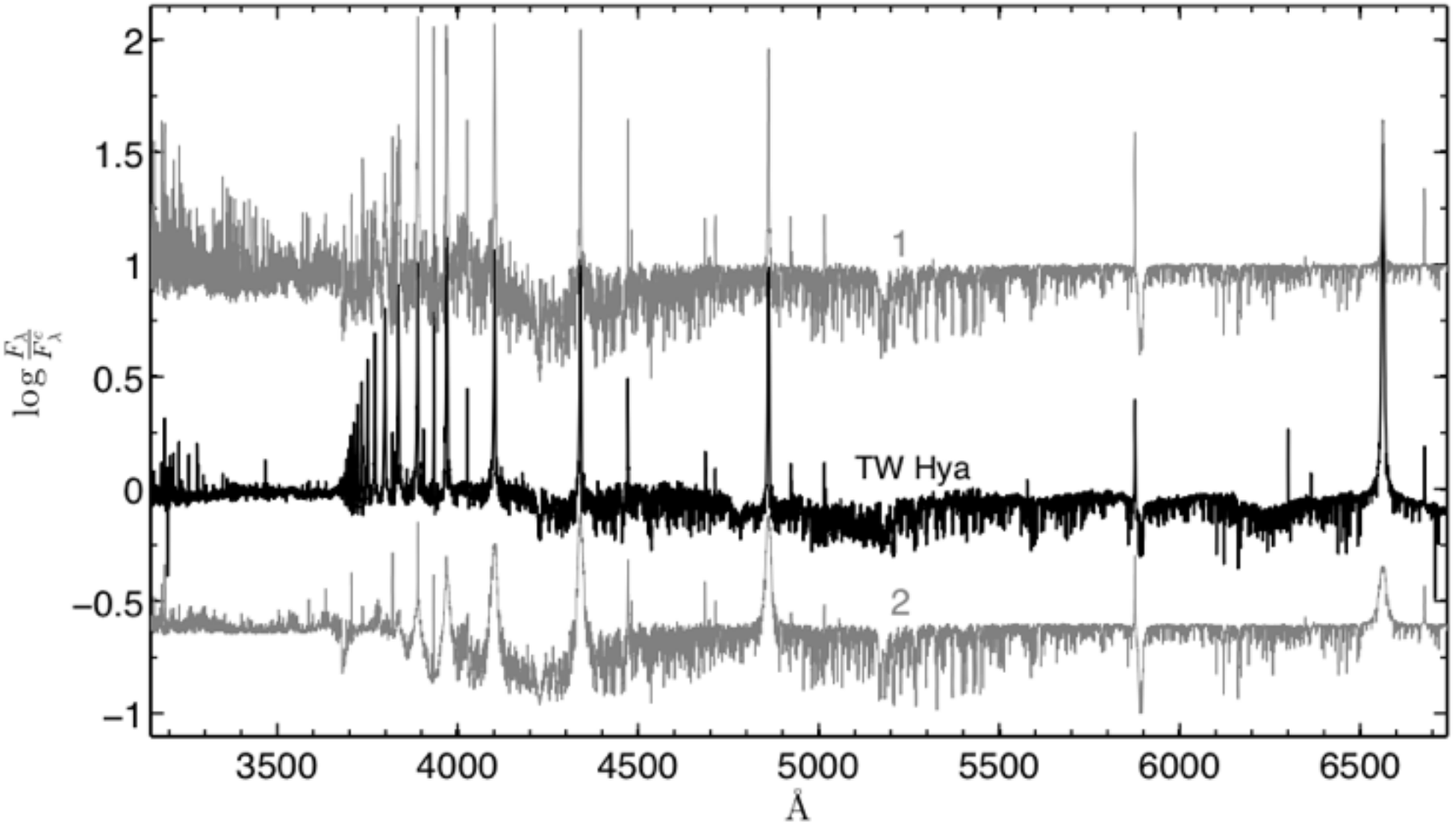
1. 静水圧平衡(動圧いり)
2. Boltzman 分布, Saha (H-Zn)
3. Non-LTE (限られた原子)
4. 輻射輸送 (上から入射光)

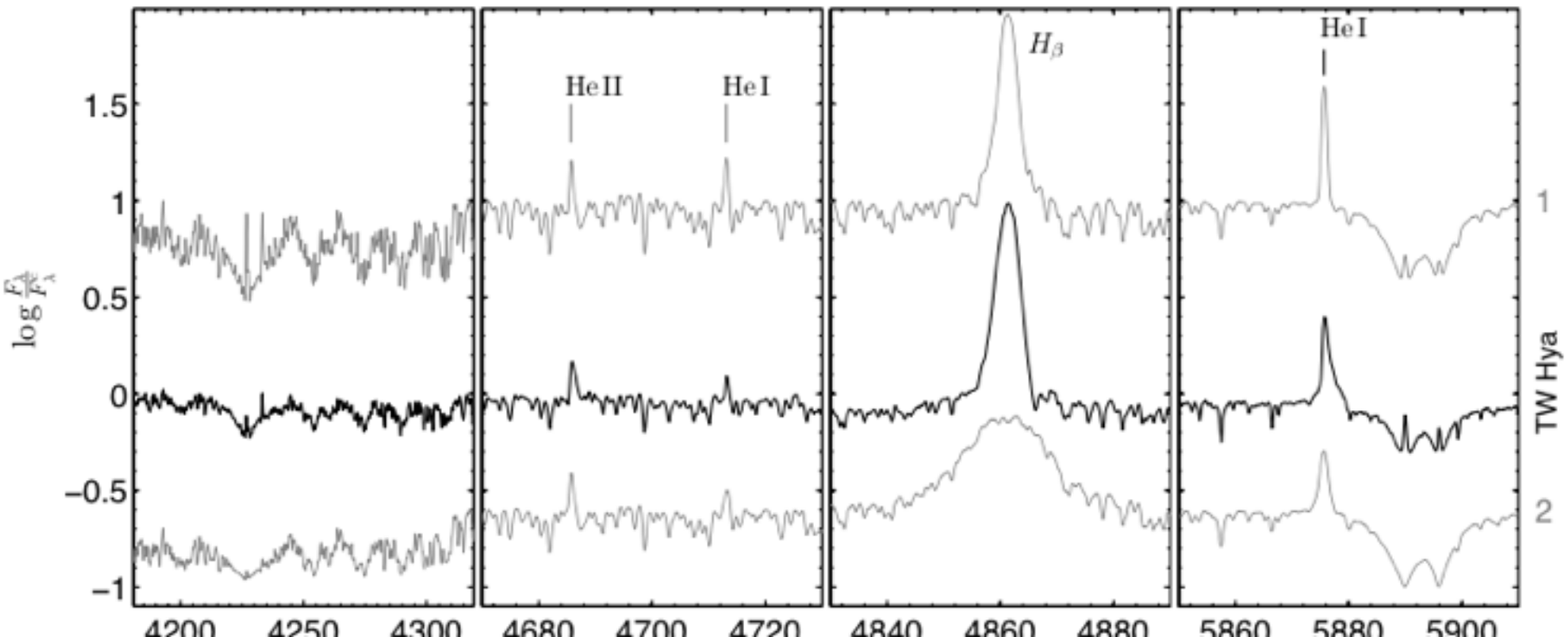






1. C, O の non-LTE 効果は有意な違いを生まない。
2. Infall による動圧は Stark Broadening を起こす。


2
1.5
1
0.5
0
−0.5
−1
$\log \frac{F_\lambda}{F_\lambda^c}$
1
TW Hya
2
3500
4000
4500
5000
5500
6000
6500
Å


He II
He I
H_β
He I
1.5
1
0.5
0
−0.5
−1
$\log \frac{F_\lambda}{F_\lambda^c}$
1
TW Hya
2
4200
4250
4300
4680
4700
4720
4840
4860
4880
5860
5880
5900

An Optical Spectroscopic Survey of the Serpens Main Cluster: Evidence for Two Populations?

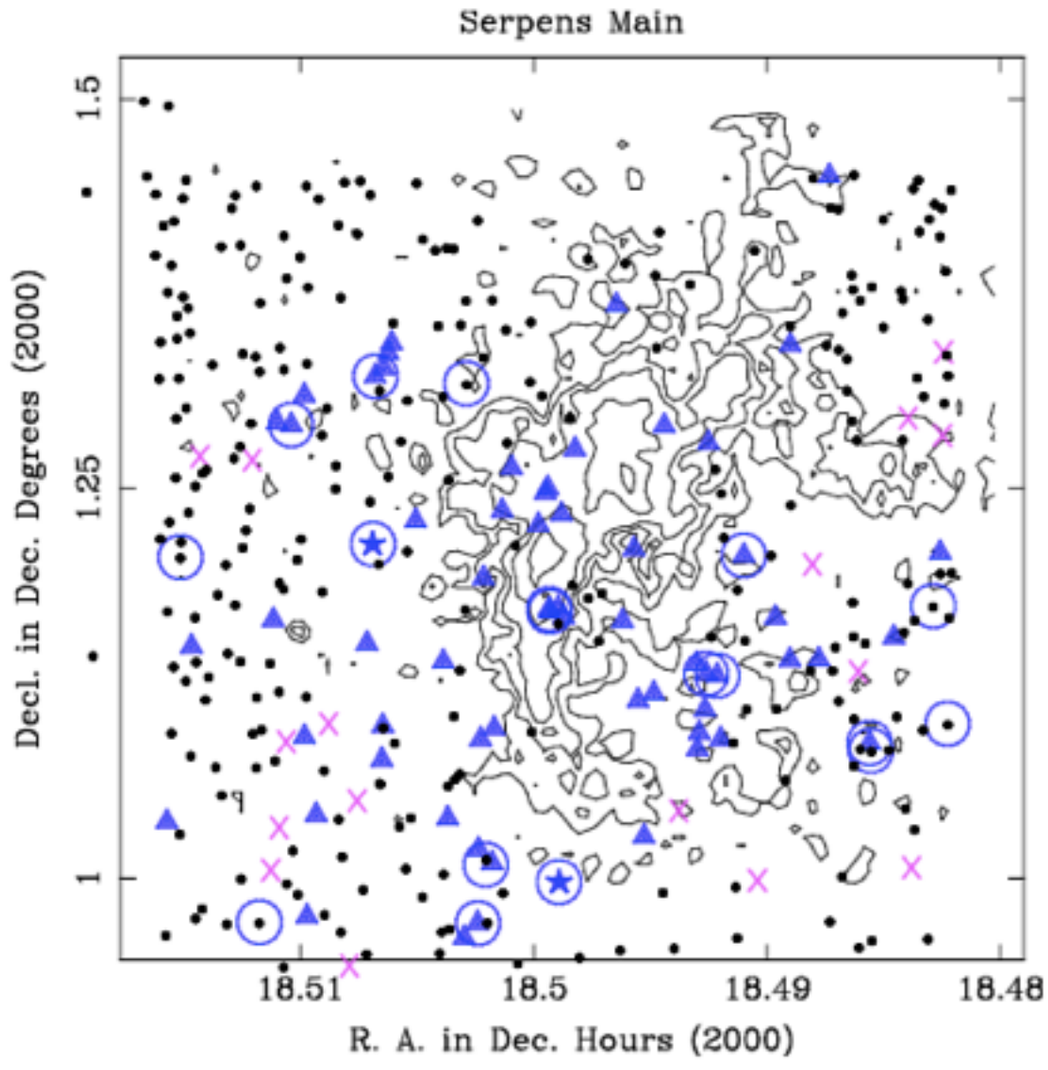
Erickson et al.

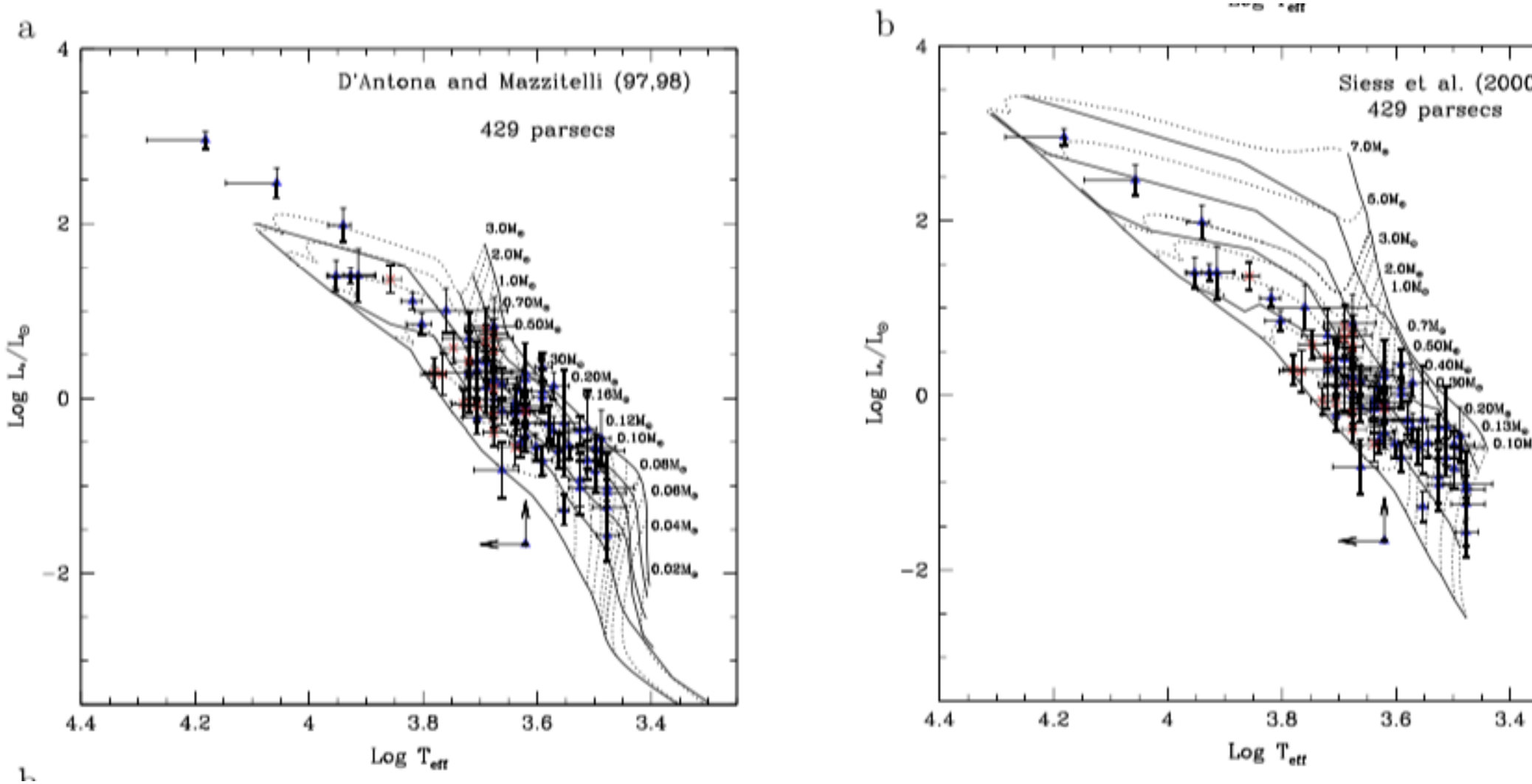
deep B, V, R band images
2.3 m Bok Telescope
complete V < 20.25, R < 18.75
30.’7×30.’7

+

λ/Δλ> 700 spectra for 345 stars

↓



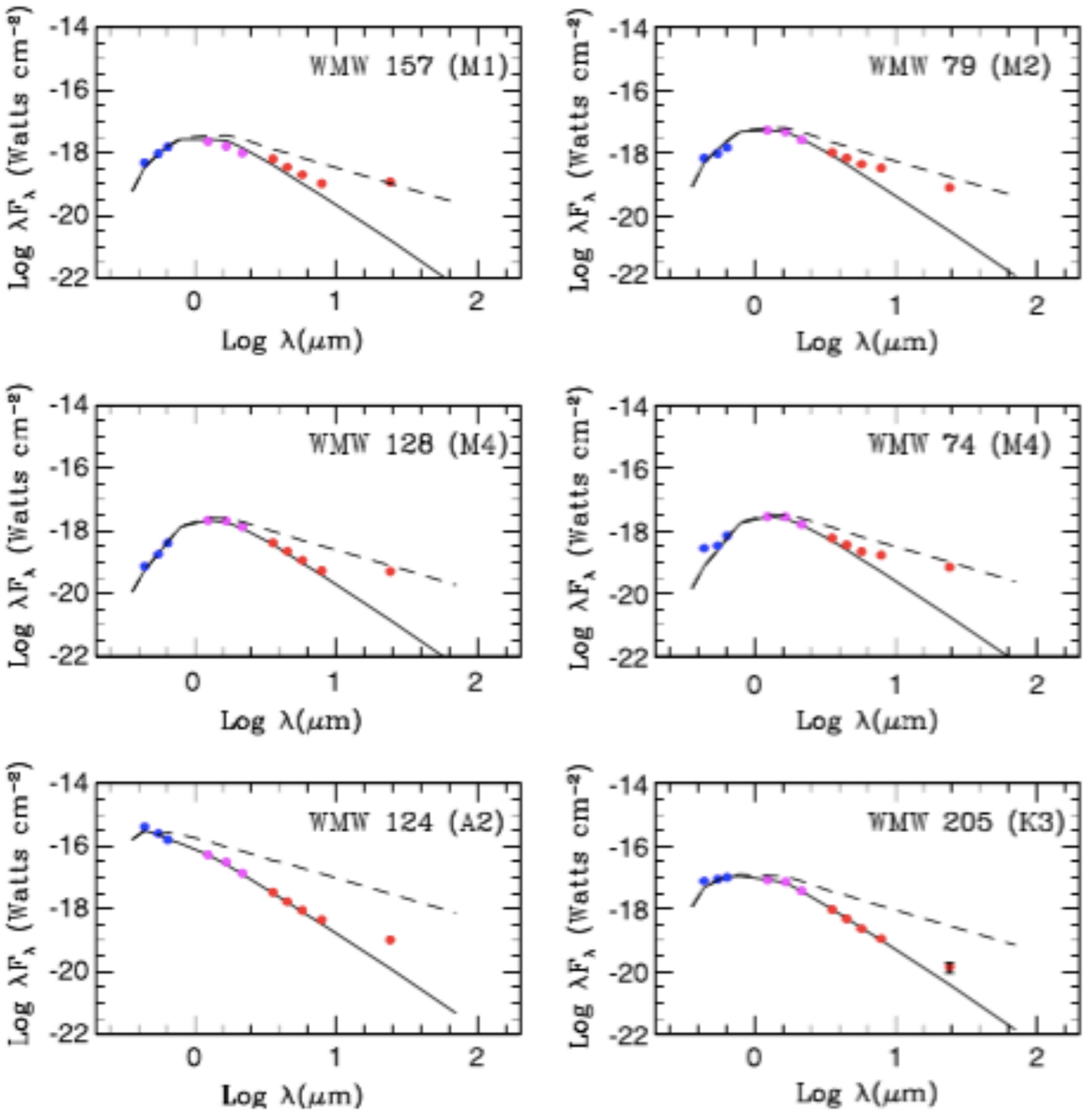


Summary

63 association members (Hα, Li, [X, MIR excess, reflection neb.])
including 15 newly identified PMS (12 Li abs. only)
+ 16 possible association members (weak Hα)
average age 〜 2 Myr (age spread は明るさの誤差の範囲)

ただし Oph に比べると luminosity の広がりがある

possible transition disk candidates



Complex organic molecules in organic-poor massive young stellar objects

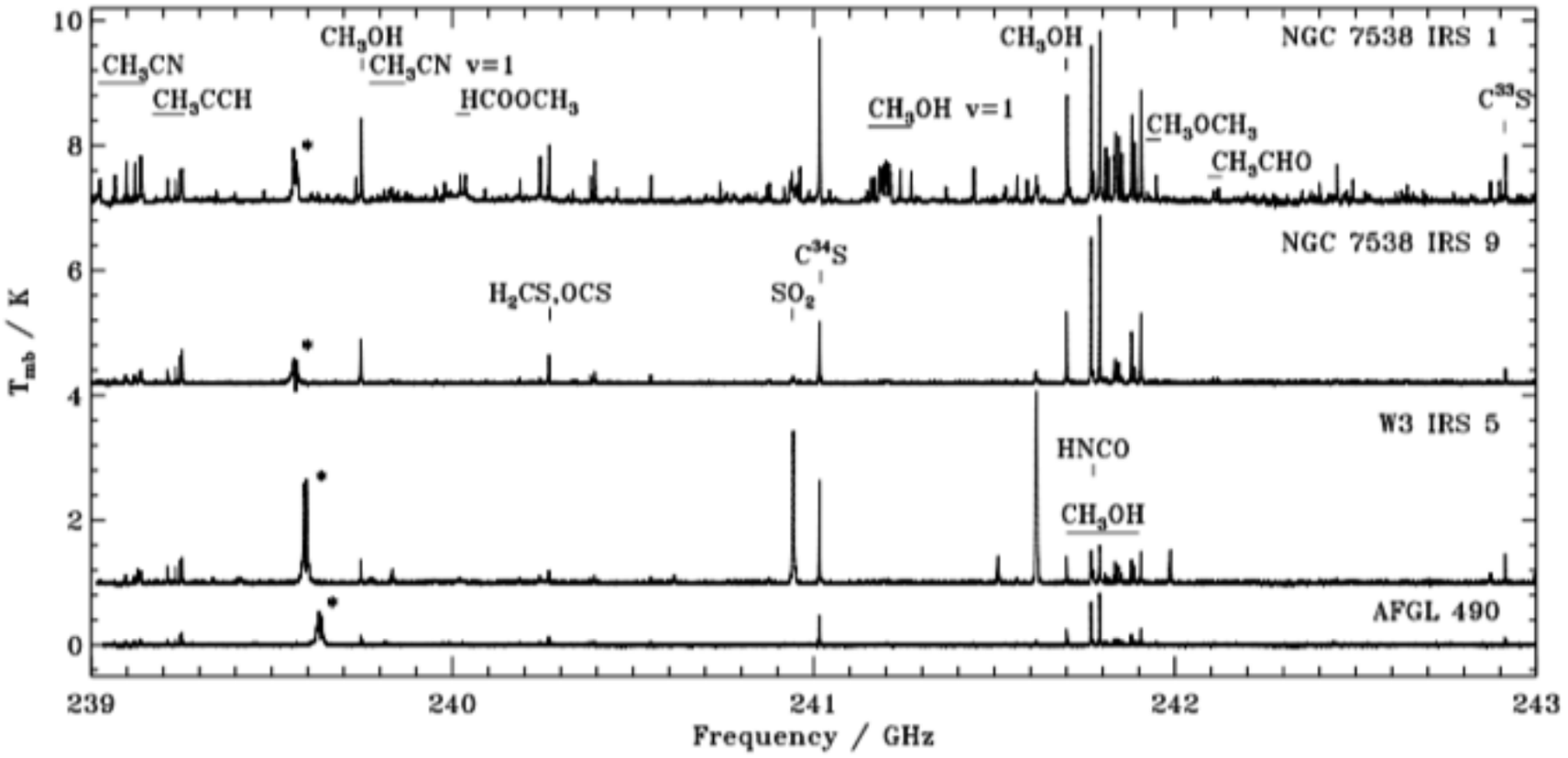
Fayolle et al. A&A

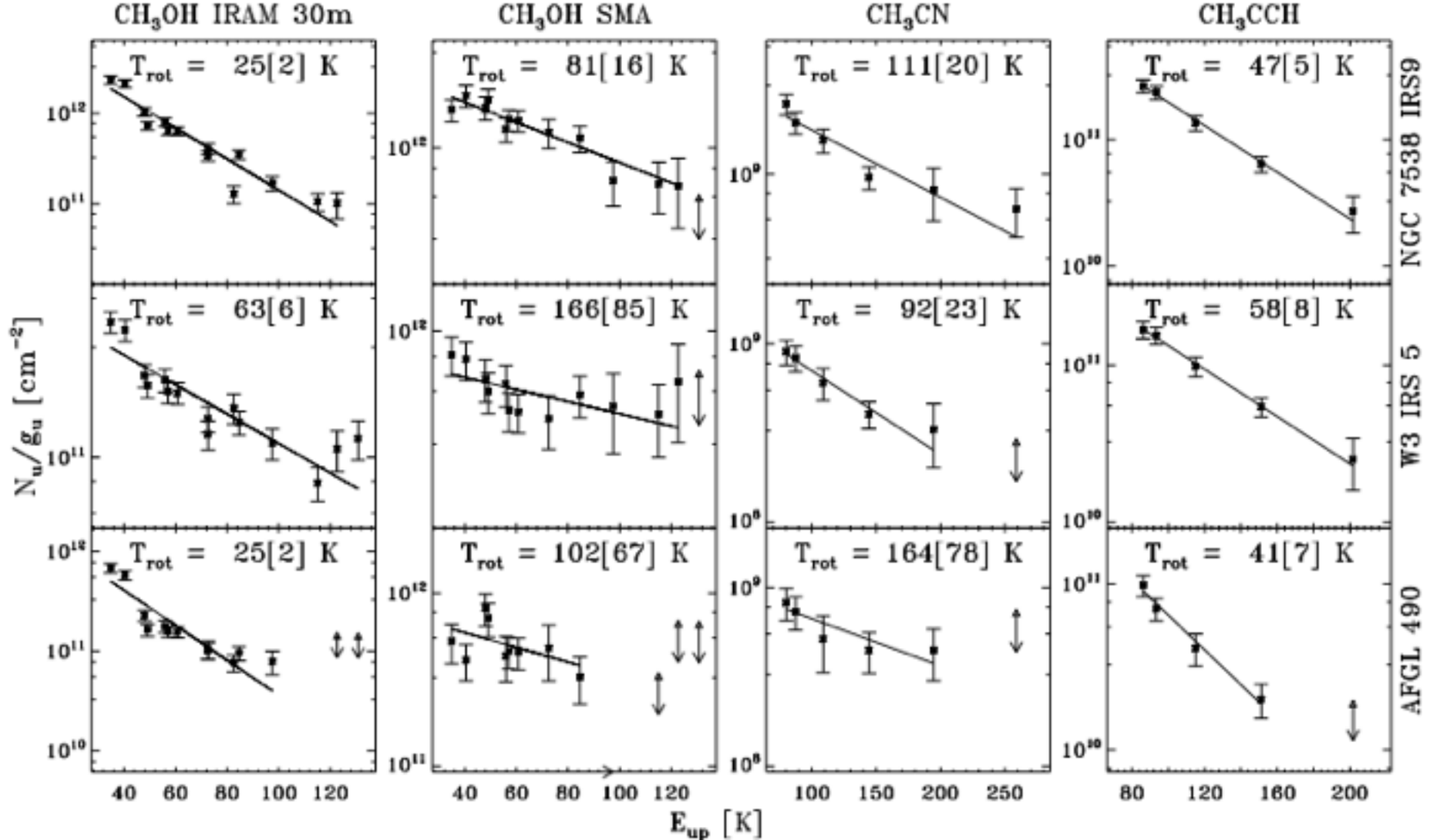
Source	α(2000)	δ(2000)	d	L	N_{H_2O}	X [%] ($/N_{H_2O}$)			
			kpc	10^4 $L_\odot$	10^{17} cm^{-2}	CH_3OH	CH_4	NH_3	OCN^-
NGC7538 IRS9	23:14:01.6	+61:27:20.4	2.7	3.5	70	4.3 ± 0.6	2 ± 0.4	15 ± 2.7	1.7 ± 0.5
W3 IRS5	02:25:40.5	+62:05:51.3	2.0	17	51	<3.3	<1.3	<5.7	<0.23
AFGL490	03:27:38.7	+58:47:01.1	1.4	0.46	6.2	11 ± 4	<2.4	<16	<1.2
W33A	18:14:38.9	-17:52:04.0	3.8	5.3	110	15 ± 5	1.5 ± 0.2	15 ± 4	6.3 ± 1.9
AFGL2591	20:29:24.6	+40:11:19.0	3.3	18	12	14 ± 2	<2.7	<2.3	–
NGC7538 IRS1	23:13:45.4	+61:28:12.0	2.4	15	22	<4	1.5 ± 0.5	<17	<0.5
Orion IRc2	05:35:14.3	-05:22:31.6	0.4	1.0	24.5	10 ± 3	–	–	2 ± 0.6
G24.78	18:36:12.6	-07:12:11.0	7.7	1.2	–	–	–	–	–
G75.78	20:21:44.1	+37:26:40.0	1.9	19	–	–	–	–	–
NGC6334 IRS1	17:20:53.0	-35:47:02.0	1.7	11	–	–	–	–	–

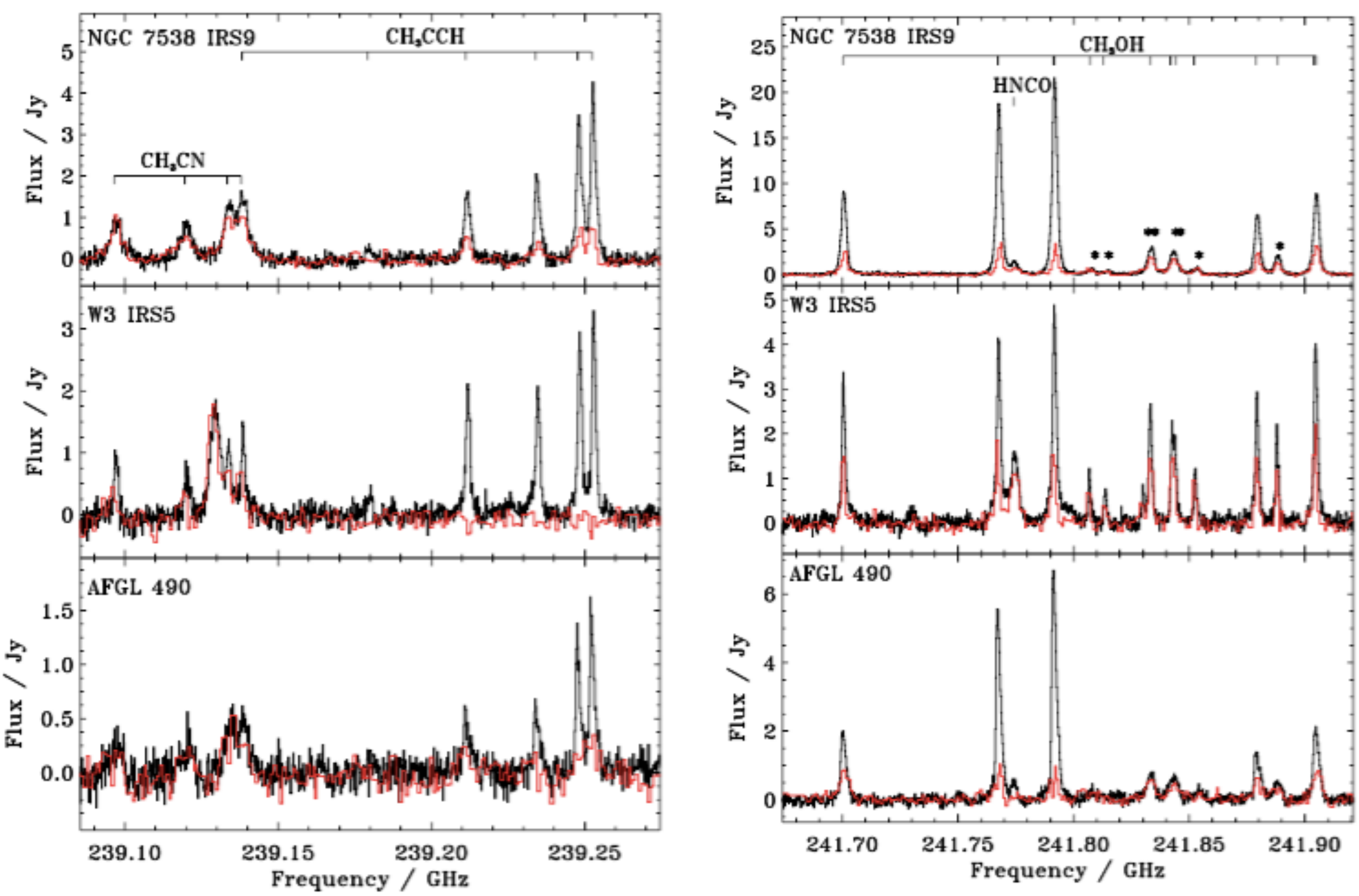
MYSOs (massive young stellar objects) でも古典的 Hot Cores と同様にCH_3CHO, CH_3CCH, CH_3OCH_3, CH_3CN, HNCO など複雑な有機分子がCH_3CO と同程度存在する（ただし相対的な重要度は異なる）。Nを含む分子は中心集中しているのにたいし、CやOを含む分子はより低温のenvelopeにも存在している。

気相での$HNCO/CH_3OH$ 比は 氷となったNH_3とCH_3OH の比と相関しているらしい。

ホットコアでなくても複雑な分子は生成される。詳しい空間分布を調べるべき。

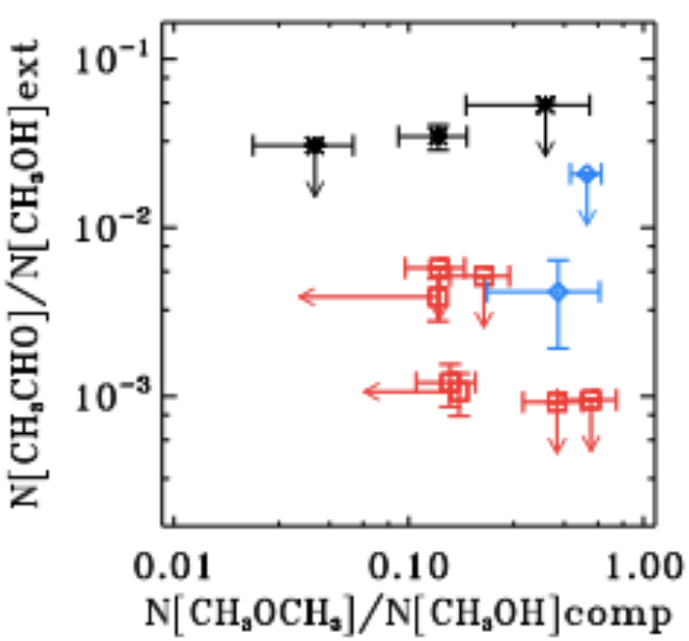

CH3CN
CH3CCH
CH3OH
CH3CN v=1
HCOOCH3
CH3OH v=1
CH3OH
CH3OCH3
CH3CHO
C33S
NGC 7538 IRS 1
H2CS,OCS
C34S
SO2
NGC 7538 IRS 9
HNCO
CH3OH
W3 IRS 5
AFGL 490
Tmb / K
Frequency / GHz

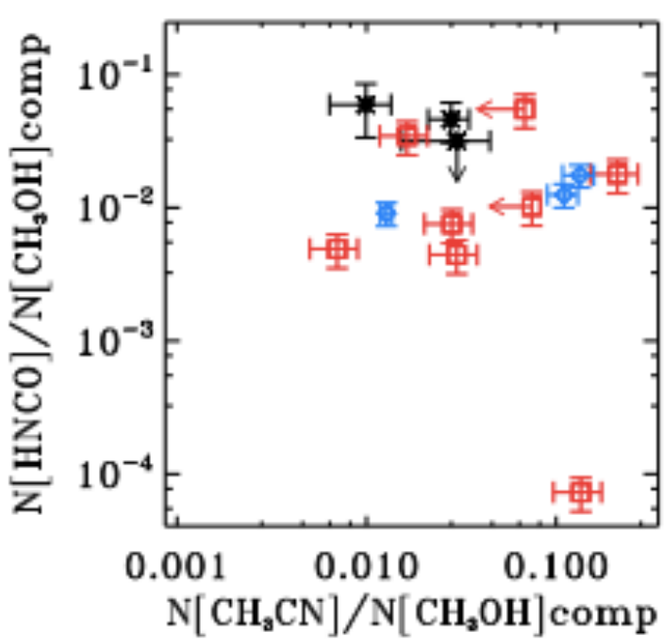

CH3OH IRAM 30m
CH3OH SMA
CH3CN
CH3CCH
Trot = 25[2] K
Trot = 81[16] K
Trot = 111[20] K
Trot = 47[5] K
Trot = 63[6] K
Trot = 166[85] K
Trot = 92[23] K
Trot = 58[8] K
Trot = 25[2] K
Trot = 102[67] K
Trot = 164[78] K
Trot = 41[7] K
NGC 7538 IRS9
W3 IRS 5
AFGL 490
Nu/gu [cm-2]
Eup [K]

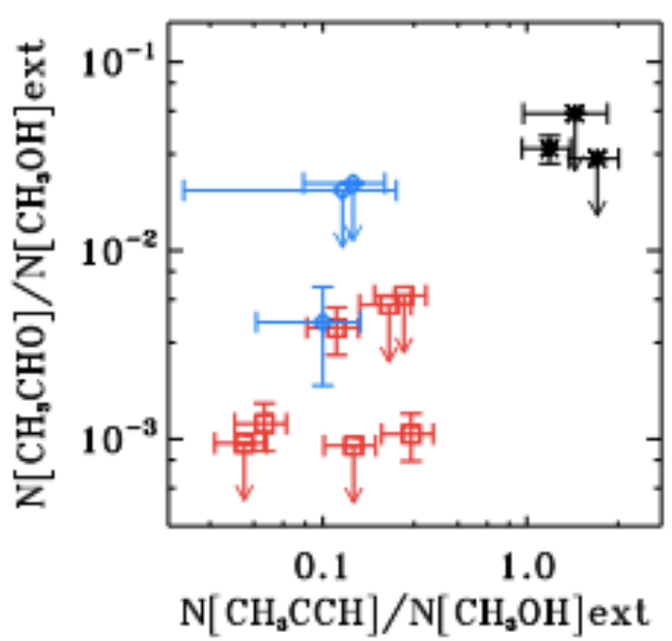


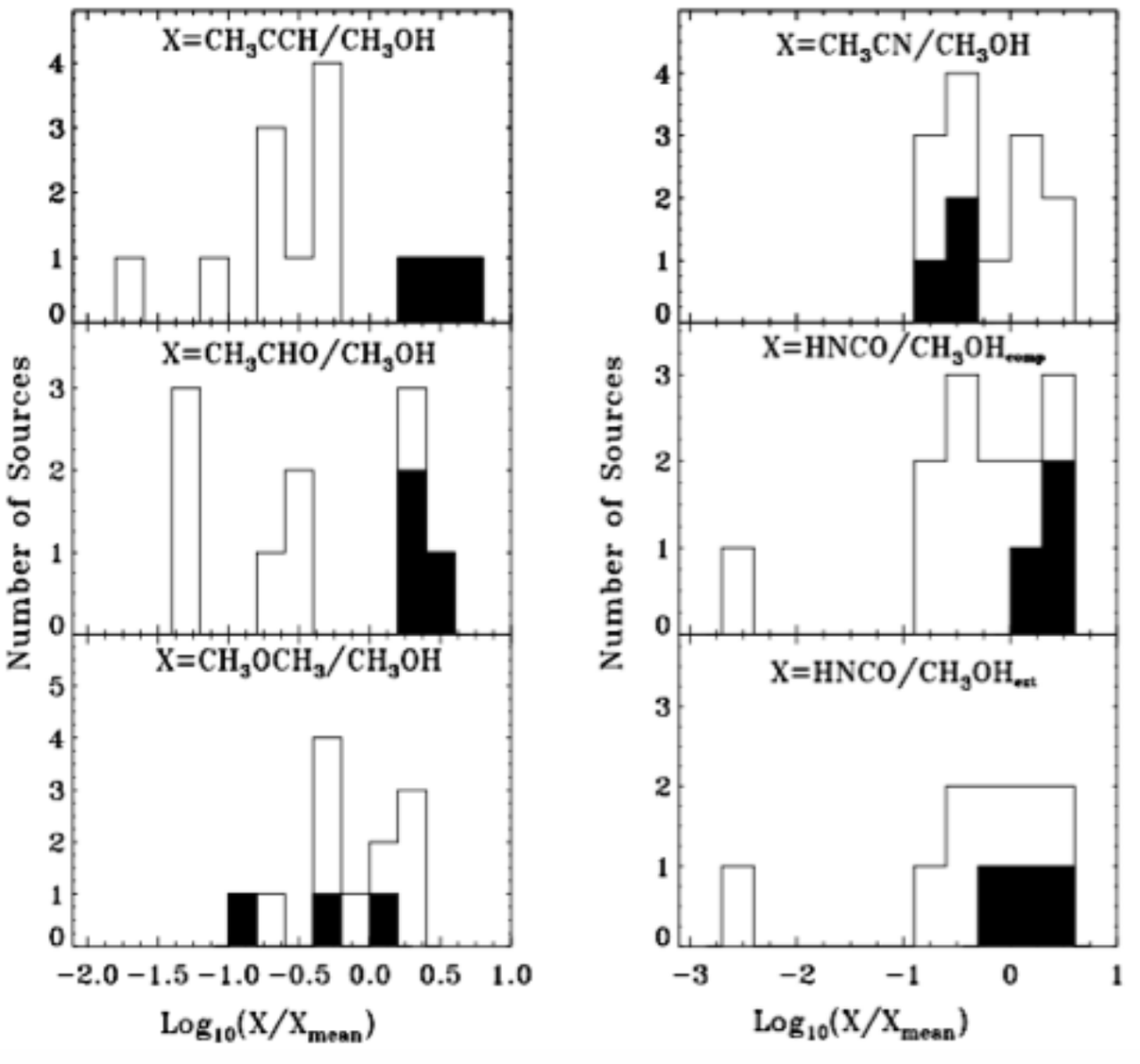
黒線: single dish

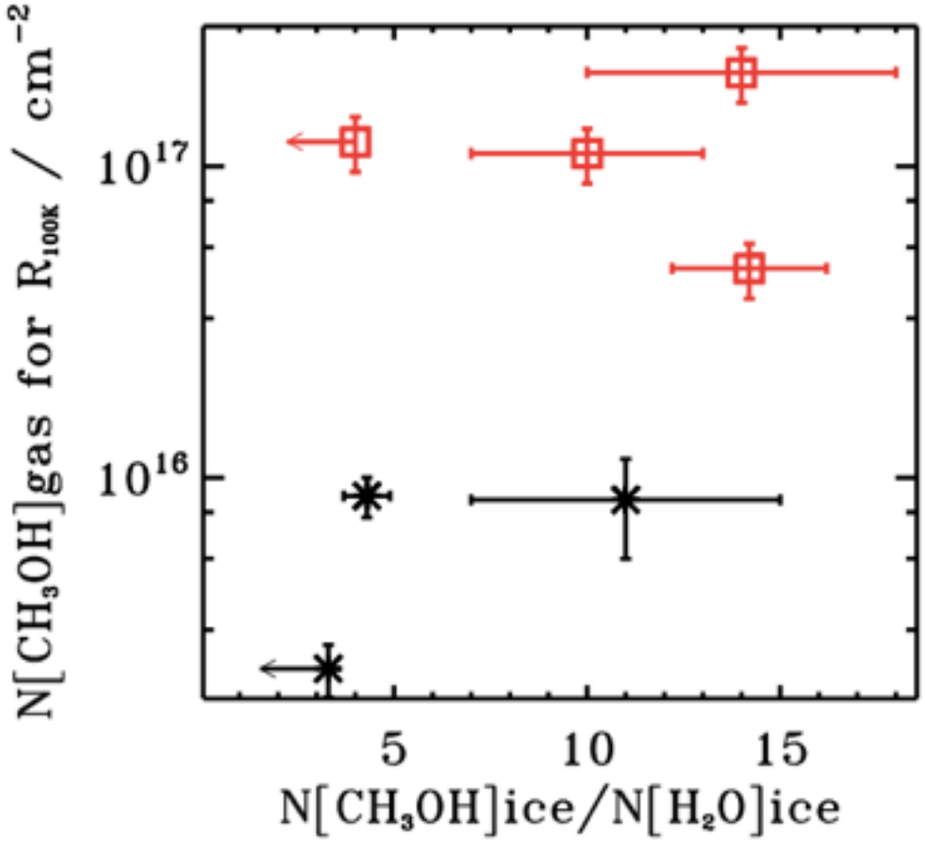
赤線: 2” baseline


N[CH3CHO]/N[CH3OH]ext
10^-1
10^-2
10^-3
0.01
0.10
1.00
N[CH3OCH3]/N[CH3OH]comp


N[HNCO]/N[CH3OH]comp
10^-1
10^-2
10^-3
10^-4
0.001
0.010
0.100
N[CH3CN]/N[CH3OH]comp


N[CH3CHO]/N[CH3OH]ext
10^-1
10^-2
10^-3
0.1
1.0
N[CH3CCH]/N[CH3OH]ext


X=CH3CCH/CH3OH
X=CH3CHO/CH3OH
X=CH3OCH3/CH3OH
X=CH3CN/CH3OH
X=HNCO/CH3OHcomp
X=HNCO/CH3OHext
Number of Sources
Log10(X/Xmean)


N[CH3OH]gas for R100K / cm^-2
10^17
10^16
5
10
15
N[CH3OH]ice/N[H2O]ice