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35. The ALMA Survey of 70 μm Dark High-mass Clumps in Early Stages (ASHES). VII: Chemistry of Embedded Dense Cores

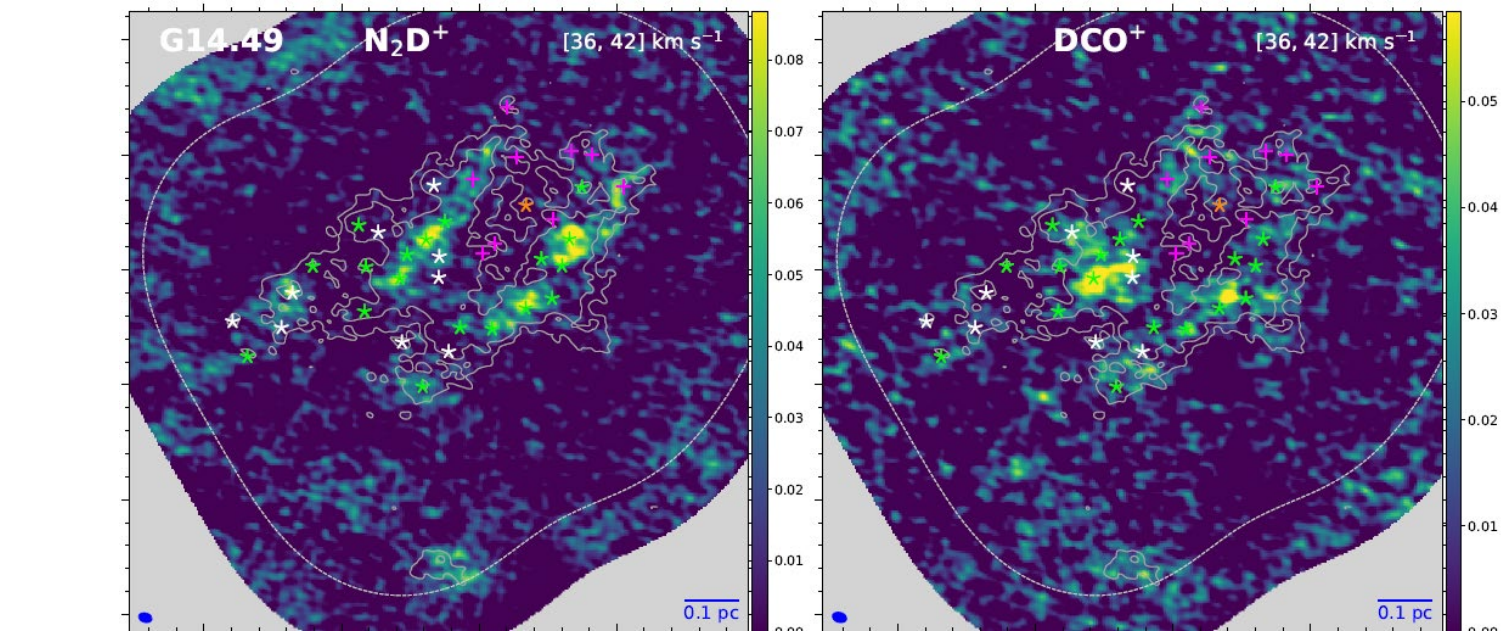
Shanghuo Li, Patricio Sanhueza, Xing Lu, Chang Won Lee, Qizhou Zhang, Stefano Bovino, Giovanni Sabatini, et al.

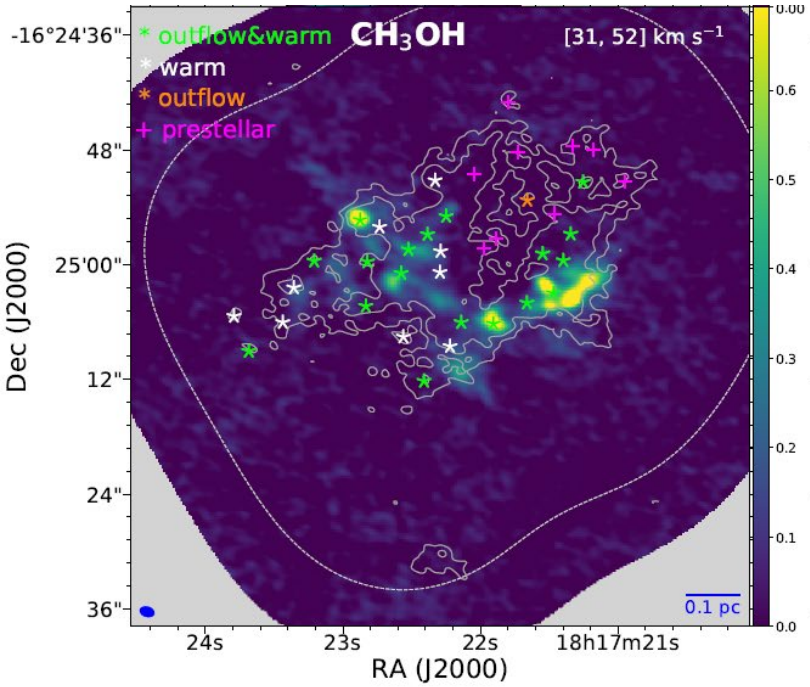
Accepted in ApJ

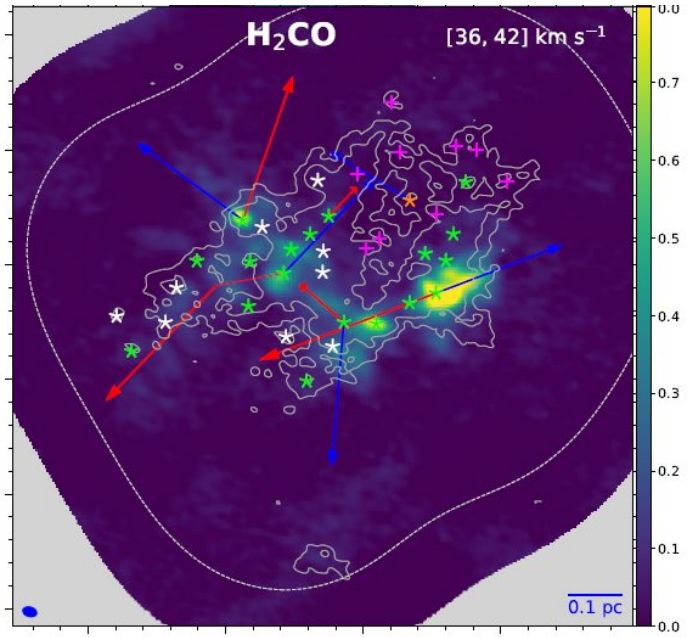
- ASHES surveyで観測した12個の分子雲クランプ中の294個の分子雲コア (星ありコア97個、星なしコア294個) からの分子線の検出率を調べた
- DCO+の検出率はN2H+の検出率よりも高かった
- DCO+とN2H+の存在量はともに星なしコアより星ありコアの方が低かった
- H2CO (52%)はCH3OH (17%)の約３倍の検出率であった
- H2COの検出率や存在量、輝線強度、線幅はコアの進化段階と共に増加し、原始星の活動性に敏感であることが示唆された

- 観測　ALMA Band 6, 12m+7m+TP
  synthesized beam size: ~1.2
  noise level:
  - continuum: 0.1 mJy/beam
  - lines: N2D+, DCO+, SiO, (DCN, C2D, 13CS): ~9.5 mJy/beam (per 0.17km/s)
    C18O, H2CO, CH3OH ; ~3.5 mJy/beam (per 1.3km/s)

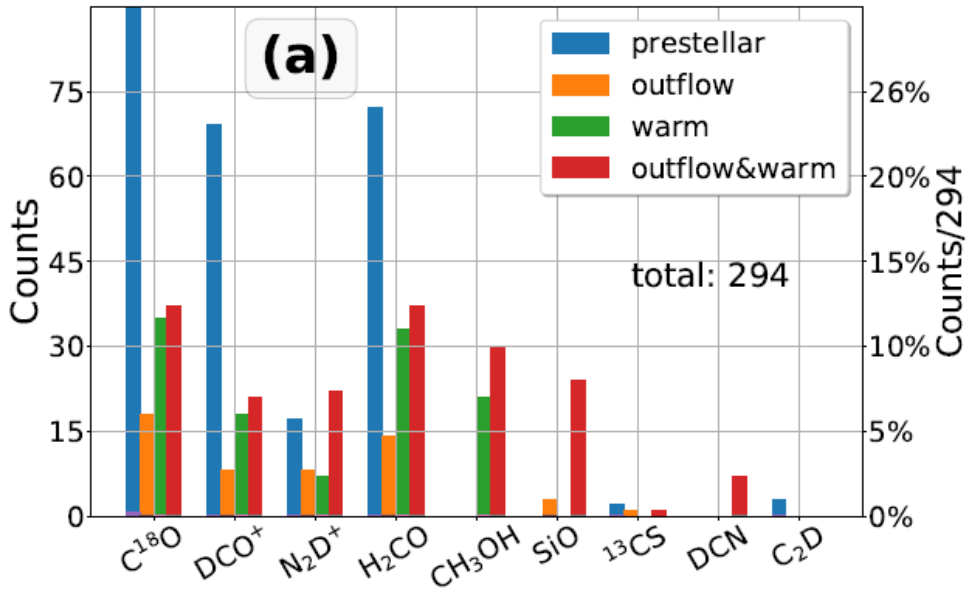
・分子線とコアの同定 (moment 0 maps)

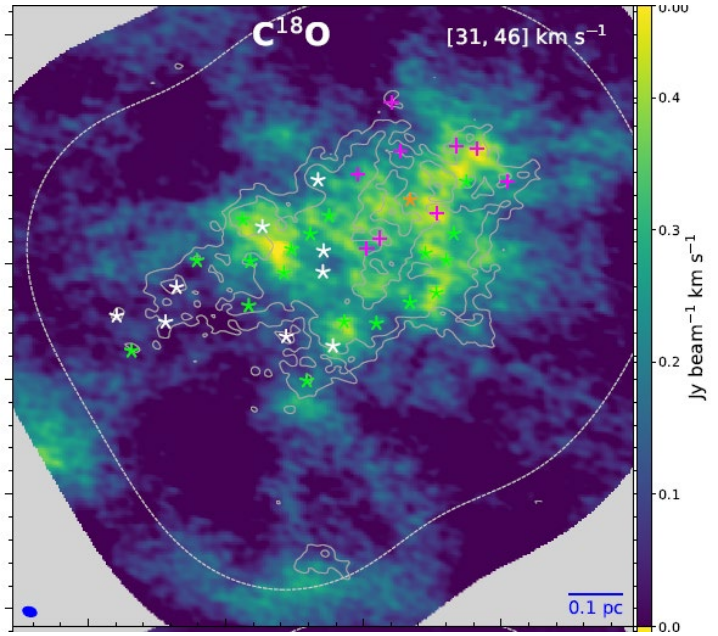




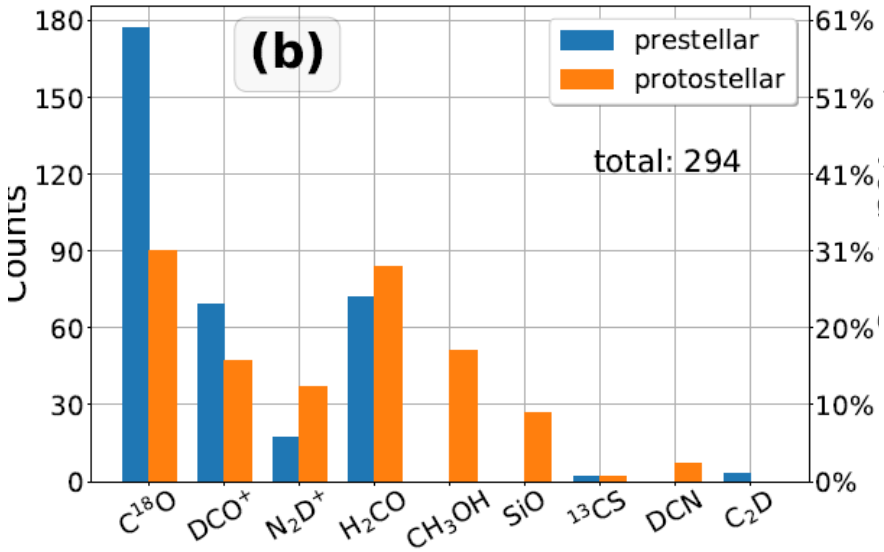


・分子線の検出率





・分子線の検出率



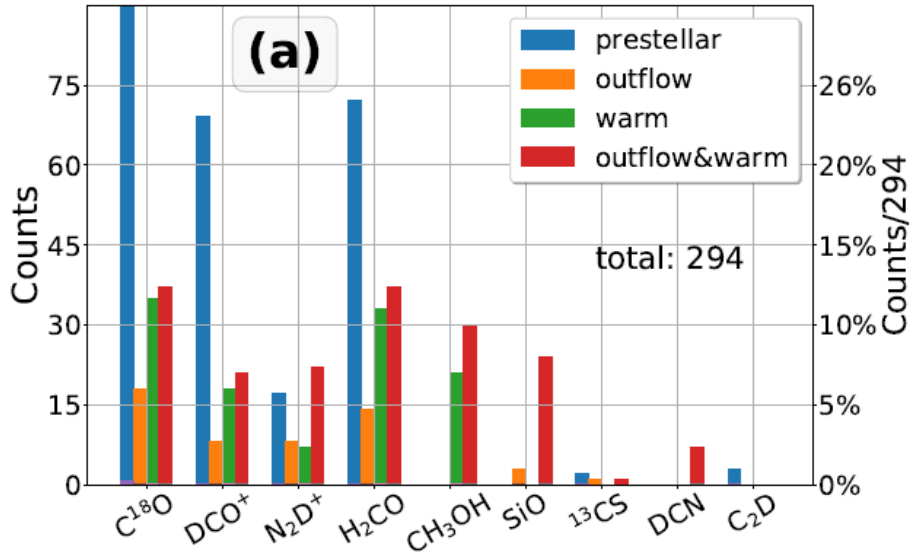
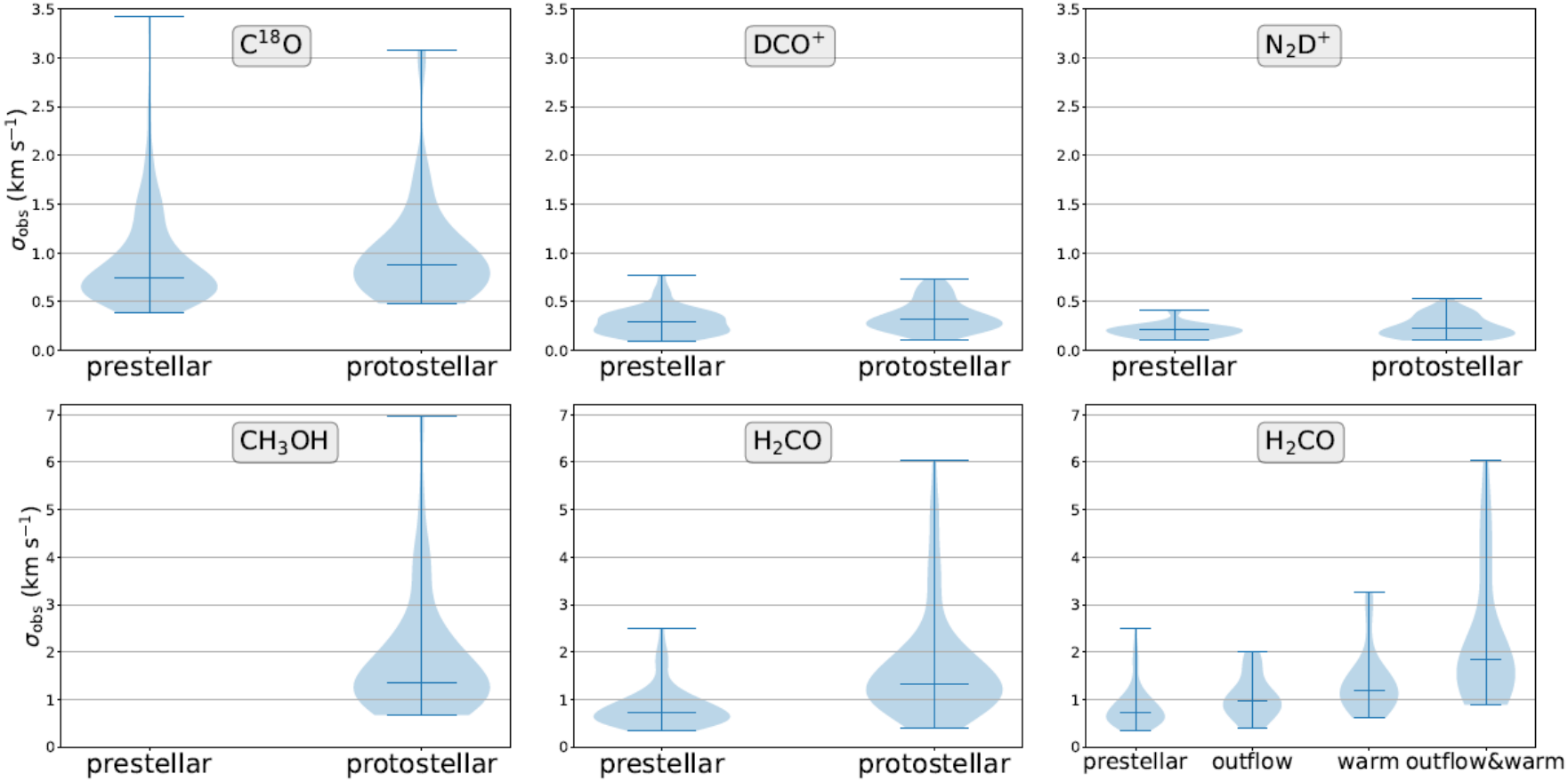


Table 2. Detection rate

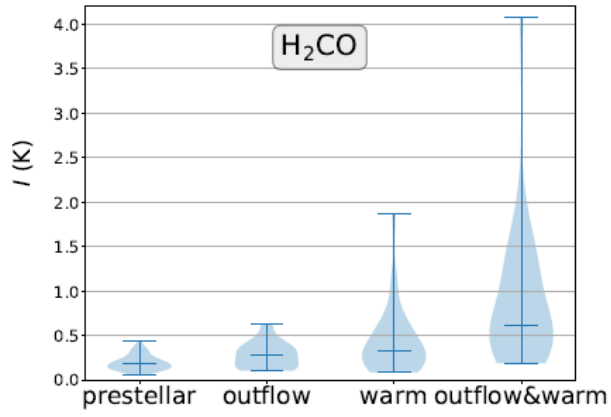
Molecules	Prestellar	Protostellar				All
		Outflow Core	Warm Core	Outflow&Warm Core	Sum	
Total Number	197	21	37	37	97	294
$C^{18}O$	177 (89.8%)	18 (85.7%)	35 (94.6%)	37 (94.9%)	90 (92.8%)	267 (90.8%)
DCO^+	69 (35.0%)	8 (38.1%)	18 (48.6%)	21 (53.8%)	47 (48.5%)	116 (39.5%)
N_2D^+	17 (8.6%)	8 (38.1%)	7 (18.9%)	22 (56.4%)	37 (38.1%)	54 (18.4%)
H_2CO	72 (36.5%)	14 (66.7%)	33 (89.2%)	37 (94.9%)	84 (86.6%)	156 (53.1%)
CH_3OH	-	-	21 (56.8%)	30 (76.9%)	51 (52.6%)	51 (17.3%)
SiO	-	3 (14.3%)	-	24 (61.5%)	27 (27.8%)	27 (9.2%)

- N2D+は必ずしも星なしコアをトレースするわけではない
- DCO+の検出率はN2H+の検出率よりも高い
- H2COの検出率は星ありコア(87%)の方が星なしコア(37%)より高い
- CH3OHは星ありコア(53%)でのみ検出されている
- SiOは主にoutflowでのみ検出されている
- 13CS, DCN, C2Dは、数個のコアでのみ検出された

・線幅の分布

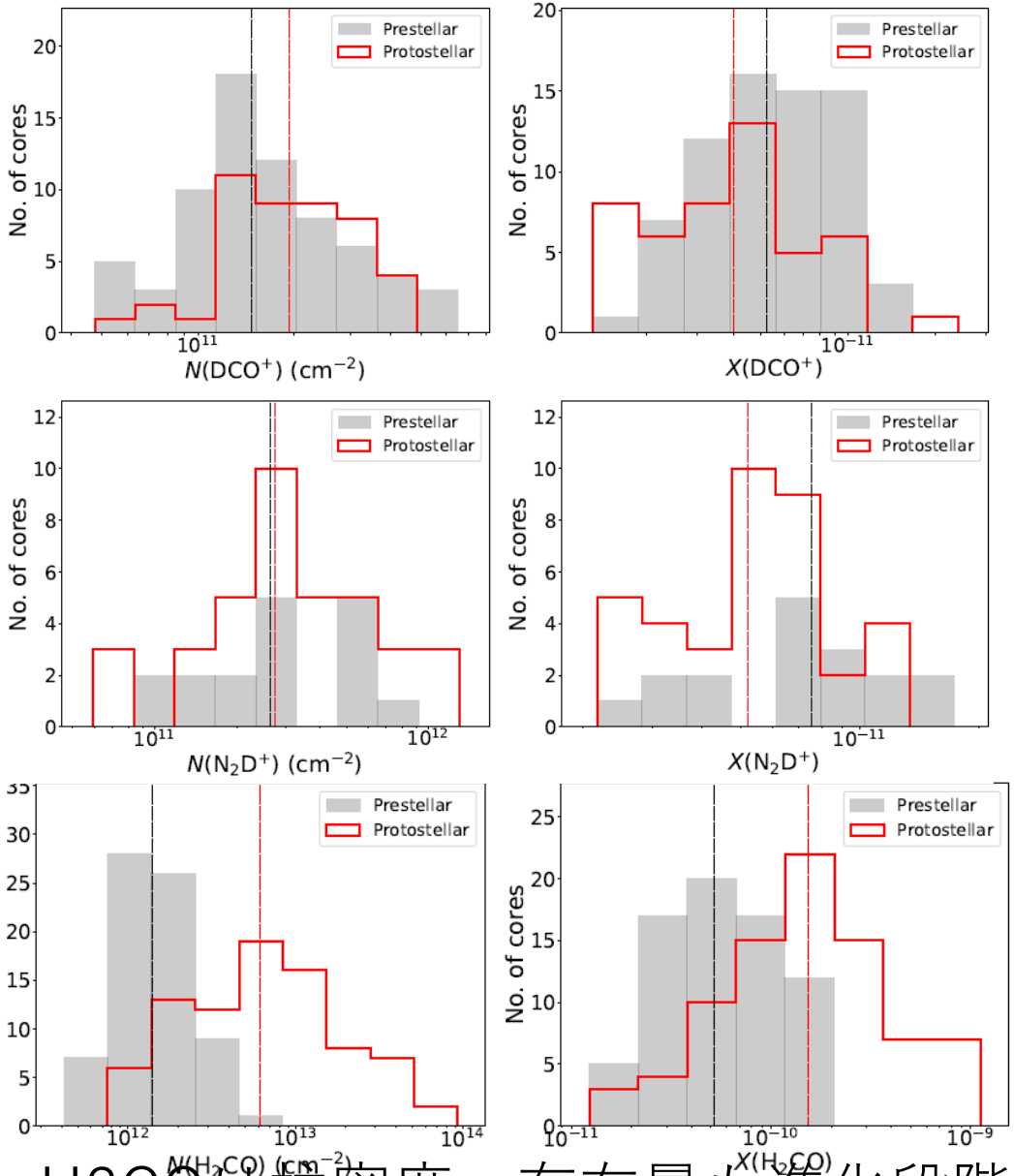


・強度の分布

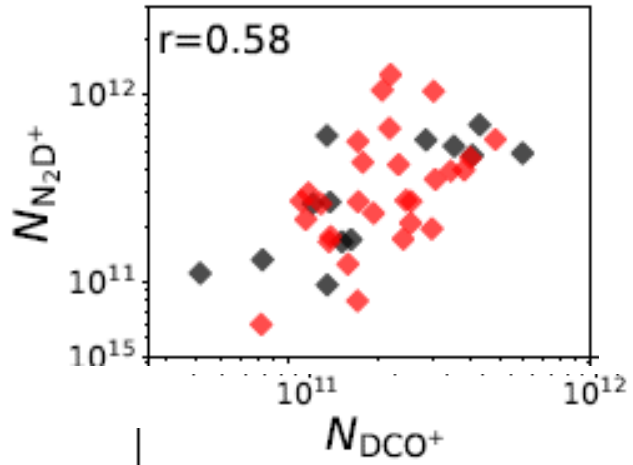


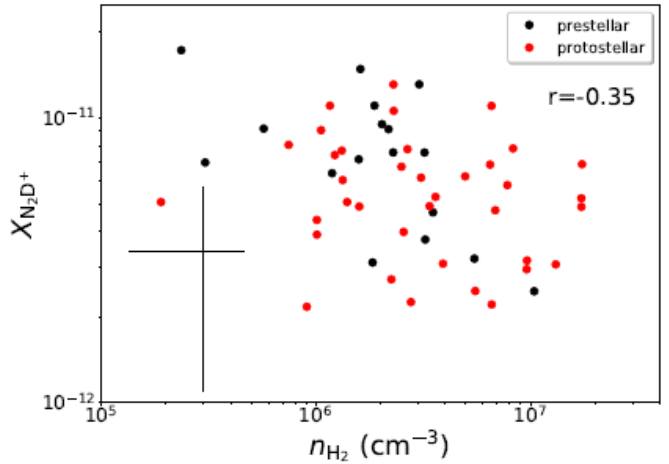
- C18O, DCO+: 星なし、星ありコアで大きな違いはない
- N2H+: 星ありコアでわずかに大きい→原始星天体の活動に伴う乱流？
- H2CO: 線幅と強度が進化と共に増加→原始星天体の活動(outflow等)による
  →H2COは原始星天体の活動のトレーサーになる

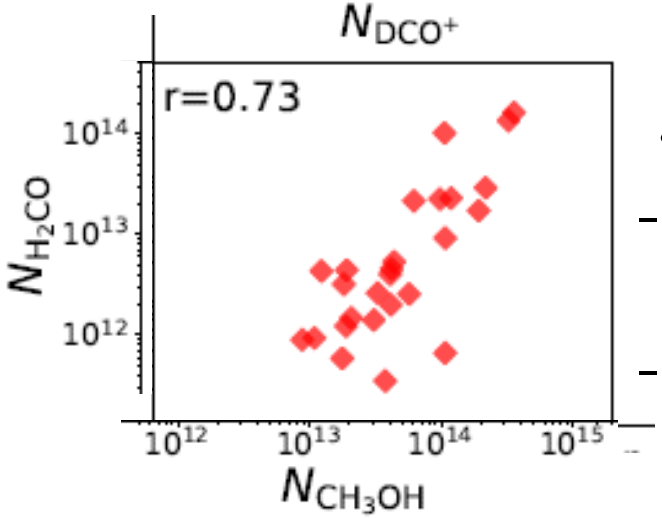
・進化段階における輝線の性質の違い

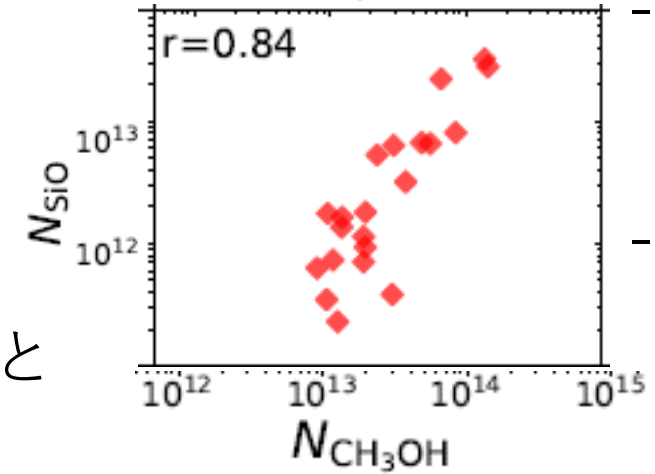


・H2COは柱密度、存在量も進化段階とともに大きくなる









・様々な相関

- N2D+ vs. DCO+
  cold & dense core
- H2CO vs. CH3OH
  ダスト表面反応＆shock?
- CH3OH vs. SiO
  Shock?
- N2D+ vs n_H
  進化(原始星による加熱)の影響？

47. Mapping the Complex Kinematic Substructure in the TW Hya Disk

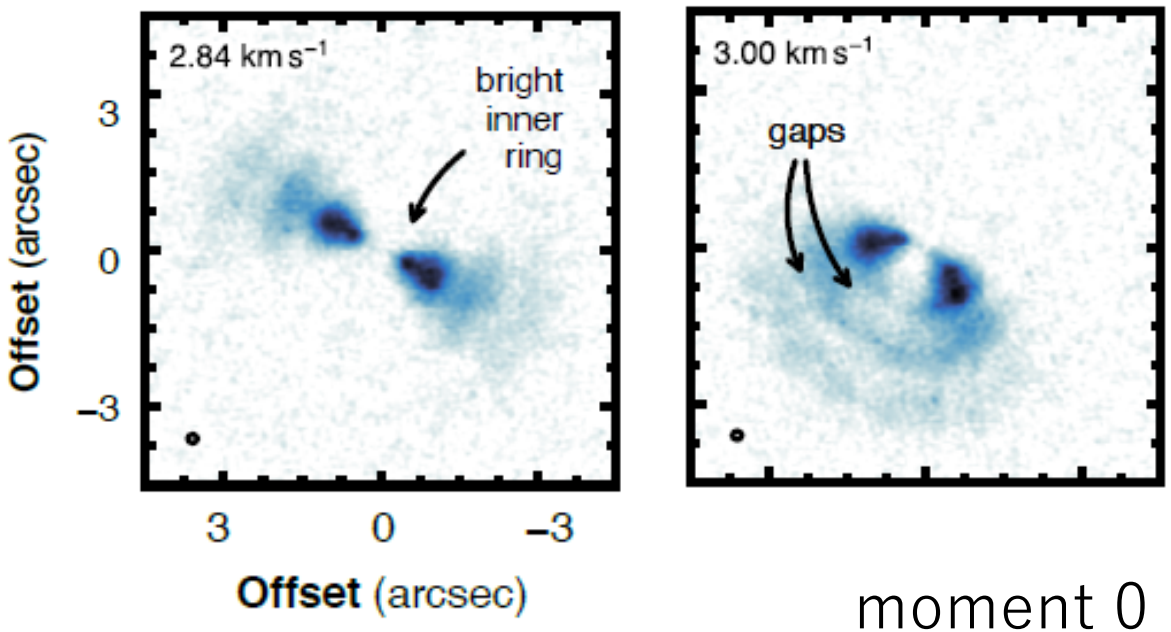
Richard Teague, Jaehan Bae, Sean M. Andrews, Myriam Benisty, Edwin A. Bergin, Stefano Facchini, et al.

published in ApJ

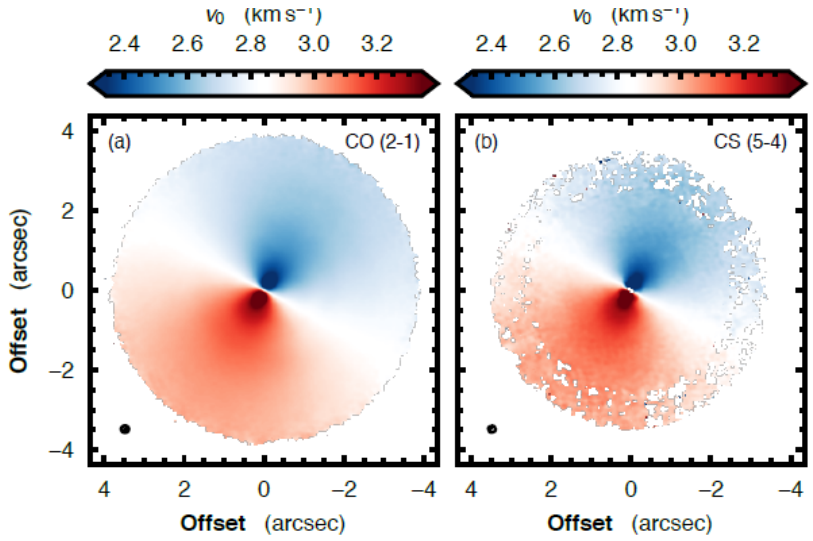
- TW Hya円盤の半径140auの位置程度の円盤外縁でCO 2-1のケプラー回転からのずれを見つけた→円盤外縁における回転速度の
- CO 2-1とCS5-4ともに半径80auの位置にケプラー回転からのずれを見つけた
- この位置は、ミリ波ダスト放射と光赤外線ダスト散乱光の撮像に見えるギャップの位置とおなじである
- さらに以前CO 3-2の観測で発見されたスパイラル構造と同様の構造を発見した
- この構造は、半径80auに土星質量の惑星が存在すると考えることで説明できる
- COとCSの詳細構造の違いは、放射領域の円盤鉛直方向の違いと考えると説明できる

- 観測　ALMA Band 6
  channel width: 40m/s
  synthesized beam size: CO: 0.19”x0.17”, CS: 0.18”x0.17”
  noise level: CO; 0.6mJy/beam, CS: 0.7mJy/beam

・観測結果：CS channel map



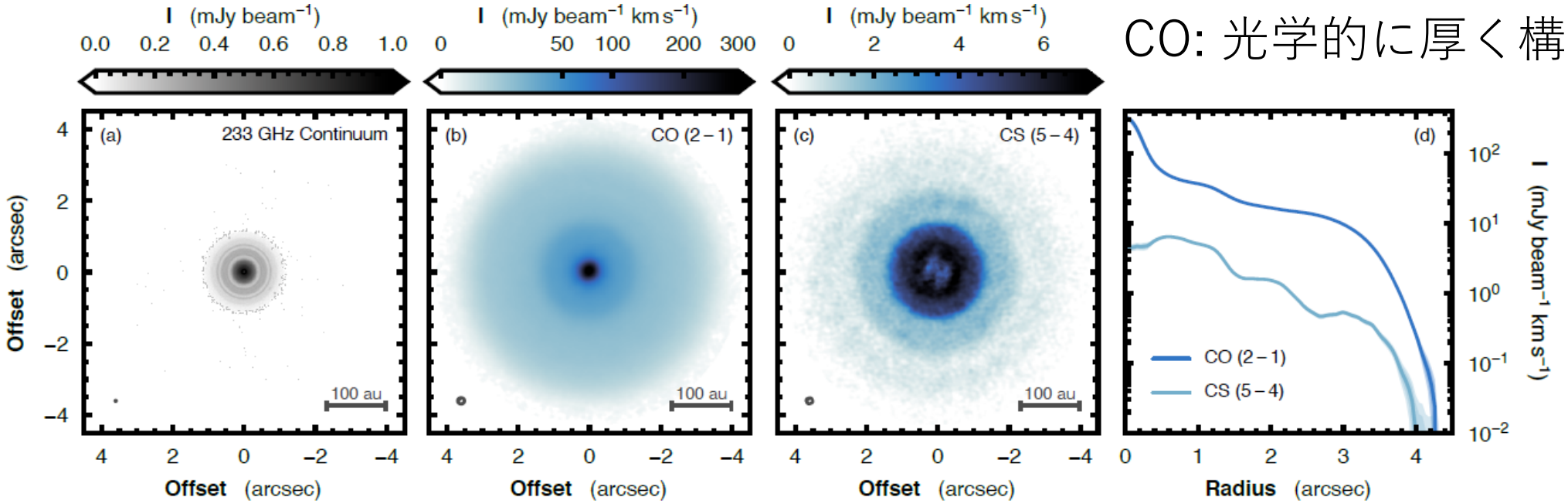
moment 1



CS: < 1”にbright inner ring,
~1.5”, 2.6” にギャップ

moment 0

CO: 光学的に厚く構造が見えにくい



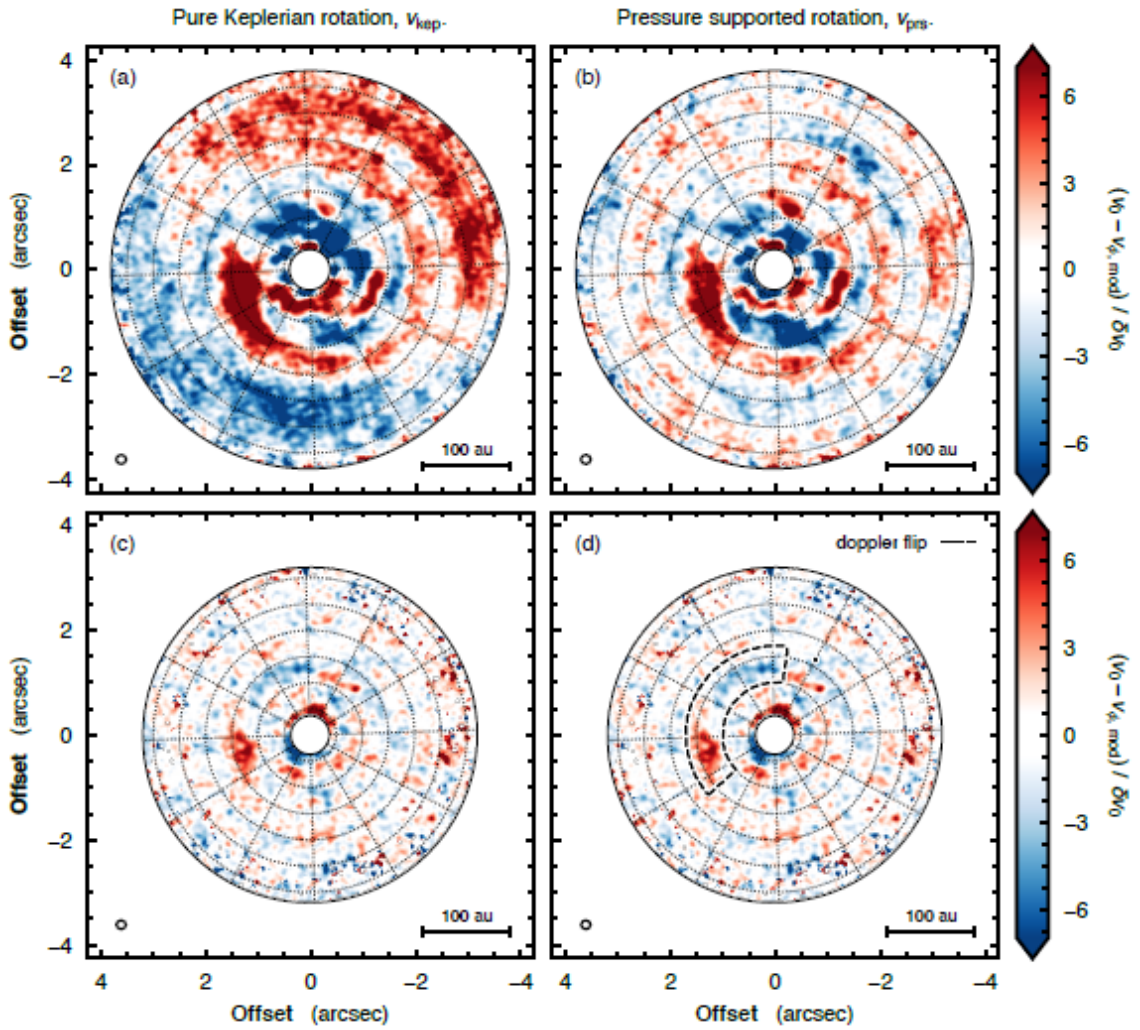
・観測結果：mom 1 mapの残差

Kepler回転成分を差し引いたもの

圧力勾配期限の成分を差し引いたもの

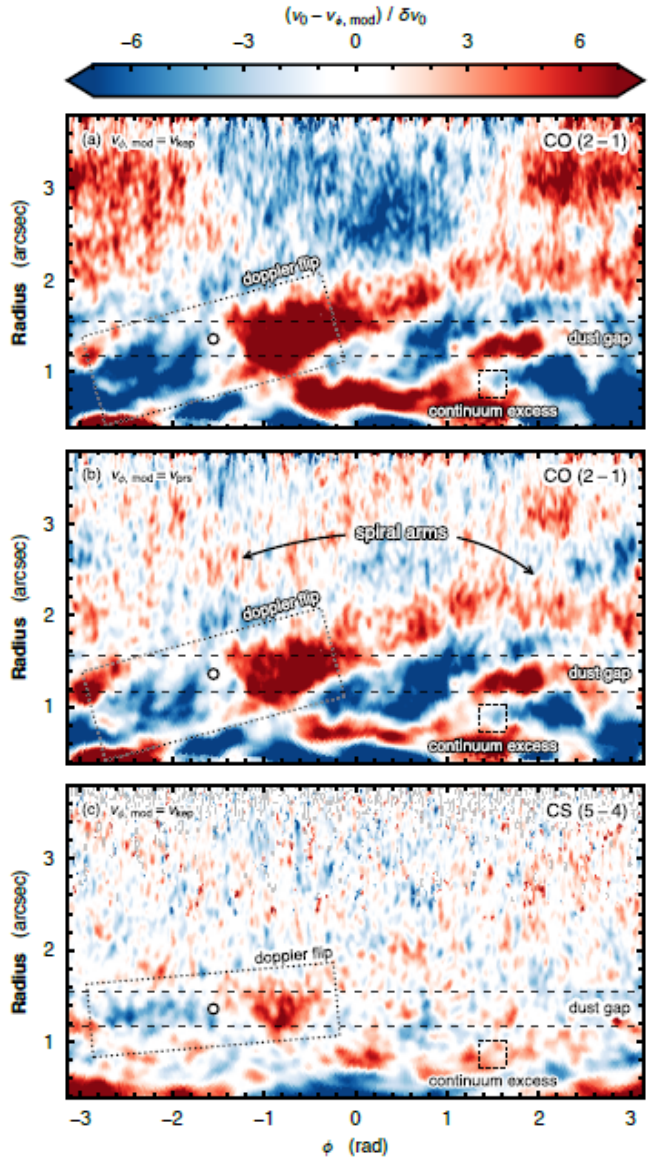
CO

CS



残った成分(Doppler flip)

→ 惑星起源？

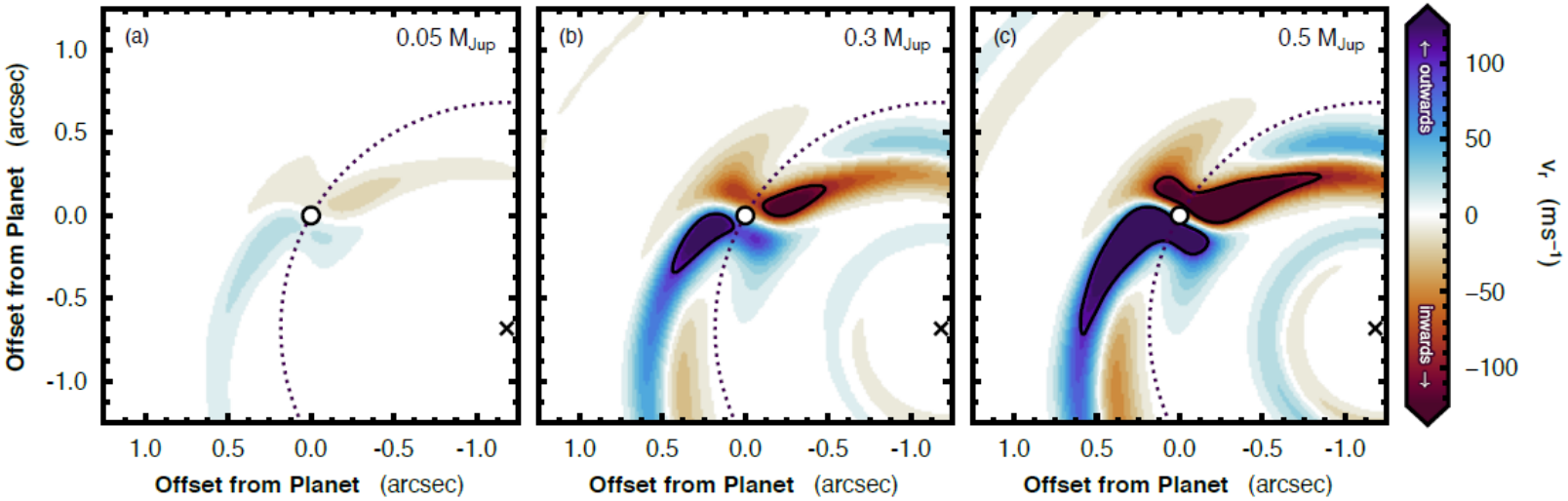


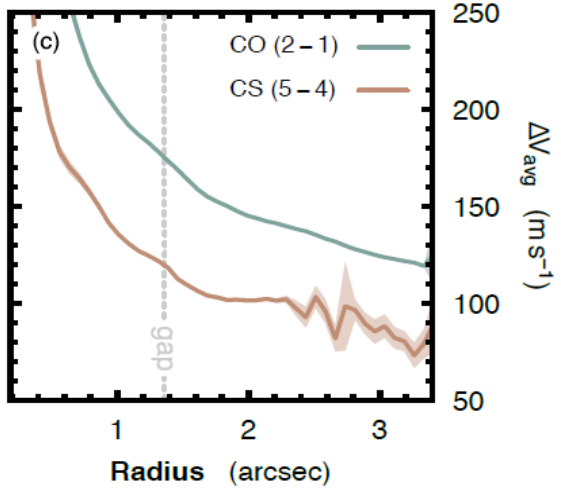
・観測結果：

- Doppler flipが見える位置は、ダストギャップ(82 au)の位置と一致
- COの残差にはspiral構造も見える (CO 3-2で見えていたものと一致)
- CSには圧力勾配起源の成分はあまりない

→ COとCSの違いの原因はは、放射領域の違い？(CO: 表層、CS: より赤道面付近)

・議論





Doppler flipのモデル計算

→ 観測の速度を再現するには0.3MJ程度が良い

→ ダストギャップやspiralを再現する惑星質量と一致

Mom 2の円盤半径分布：

惑星起源の擾乱は見られなかった

20. Discovery of a brown dwarf with quasi-spherical mass-loss

Dary A. Ruíz-Rodríguez, Lucas A. Cieza, Simon Casassus, Victor Almendros-Abad, Paula Jofré, et al.

Accepted for publication in ApJ

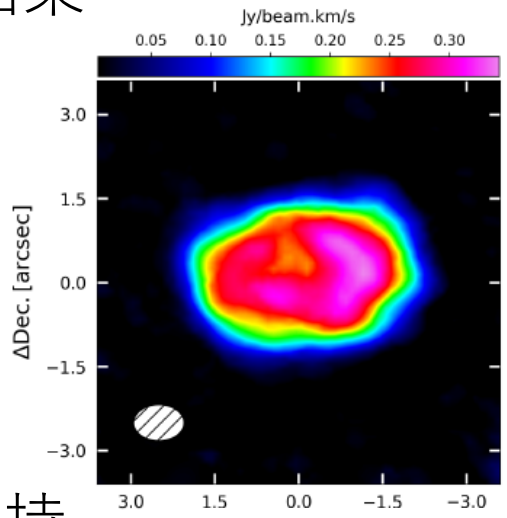
・ALMA ODISEA (Oph disk survey)で星に付随するCOガスを検出した
・CO brightでダスト連続波の検出はなし (circumstellar envelope like) (~3”x~4”)
・VLTでnear-IR spectrumの追観測 → 遠方(>5-10kpc)の巨星ではなく、
近傍(~139 pc)の若い褐色矮星と結論
・若い褐色矮星からの球状の質量放出の初検出
→ 重水素核融合のthermal pulse起源？

惑星の衝突のようなexotic scenarioも棄却はできない？

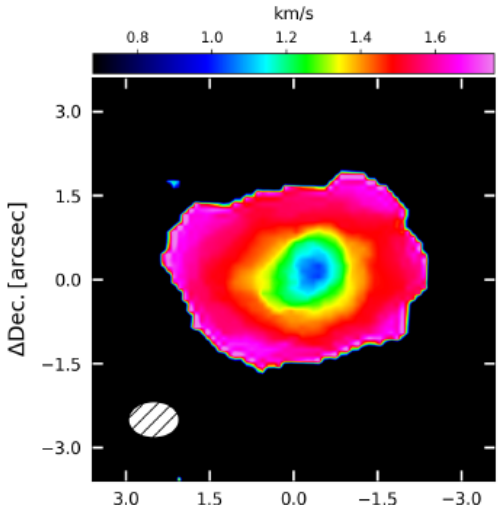
・観測　ALMA Band 6
Ophiuchus Disk Survey Employing ALMA (ODISEA)
beam size: 0.25”/0.8”
noise level: 0.15/0.25 mJy/beam

・ALMA 観測結果

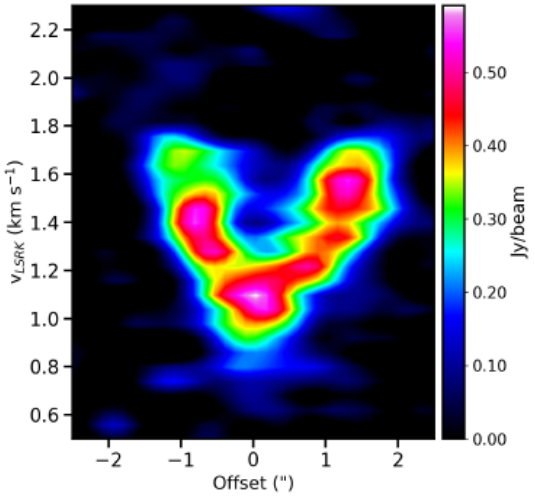
Mom 0



Mom 1



PV図



(c)

・VLT観測

VLT観測結果は褐色惑星を支持。

銀河内の固有運動も巨星より遅い