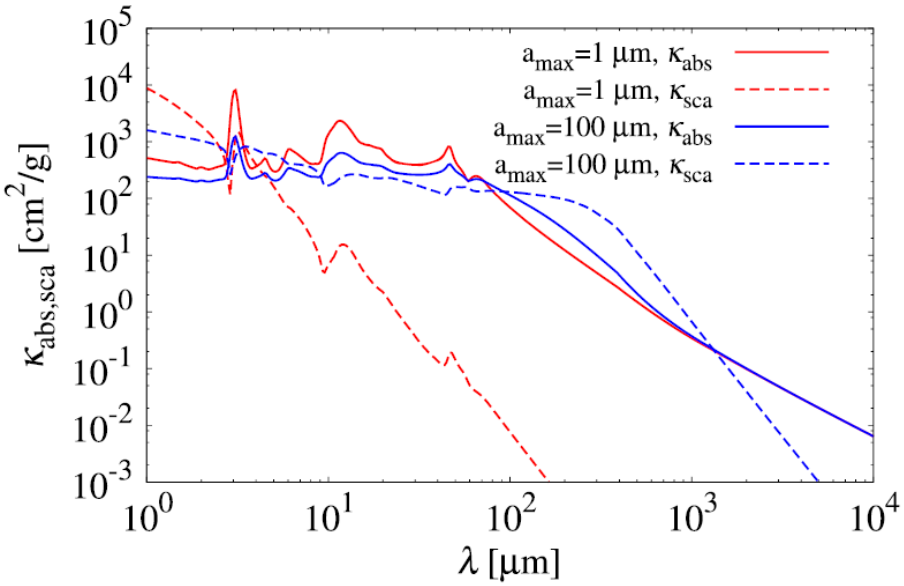
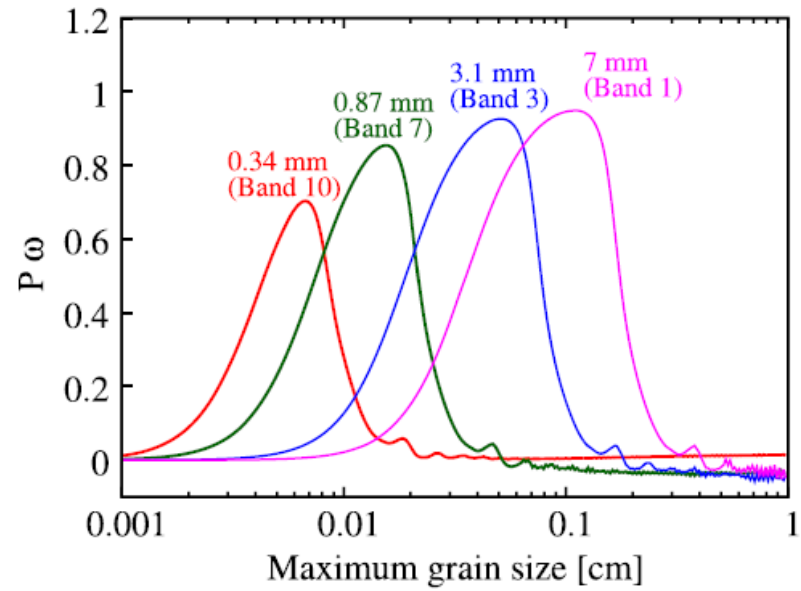
# Millimeter-wave polarization of protoplanetary disks due to dust scattering

Akimasa Kataoka et al.



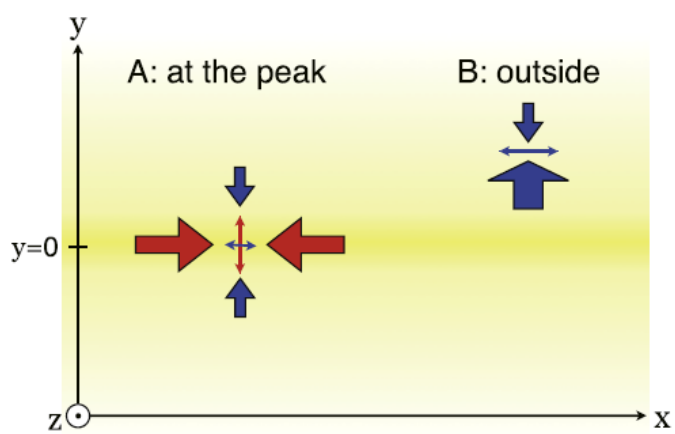




**Figure 6.** Schematic picture of the mechanism of the polarization due to scattering of anisotropic radiation field.

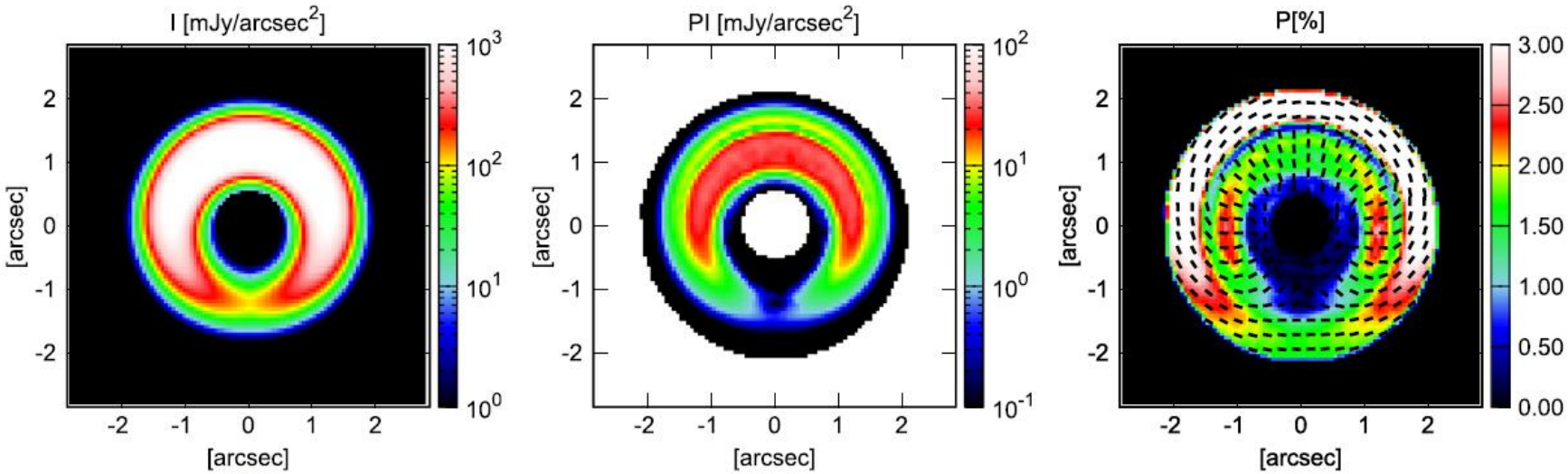


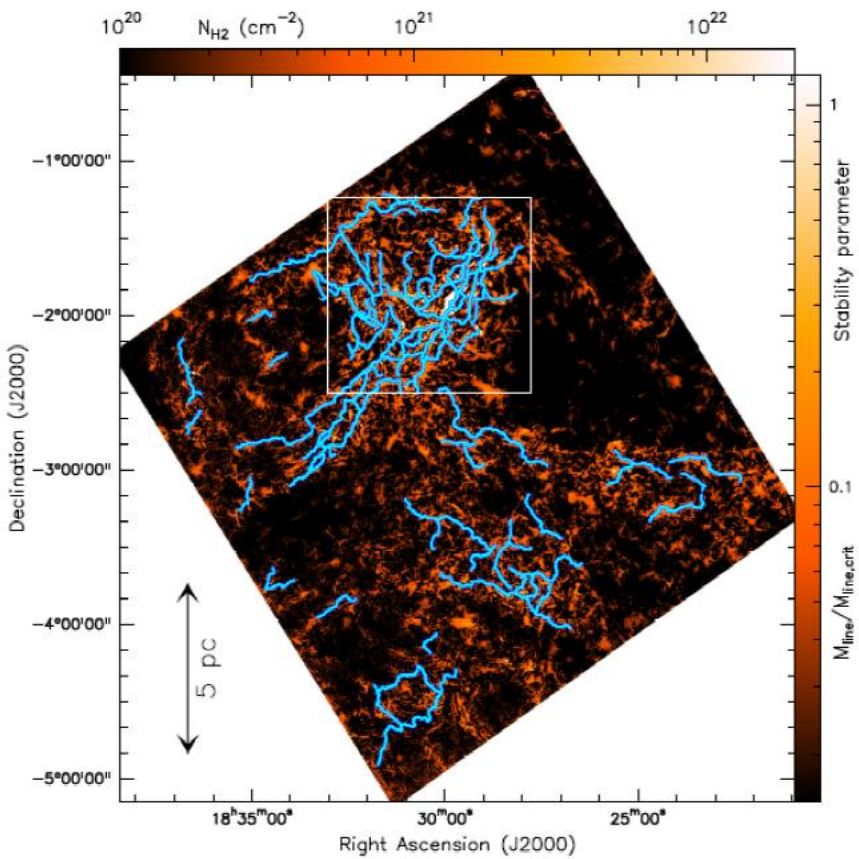

**Figure 9.** Same as Figure 5, but for model B. At the top peak, the optical depth exceeds unity, which is realized in HD 142527, for example. Note that the polarization degree is saturated at the outer ring in the right panel to emphasize the polarization degree of the inner ring. The outer ring is unlikely to be detected because the polarized intensity is weak.

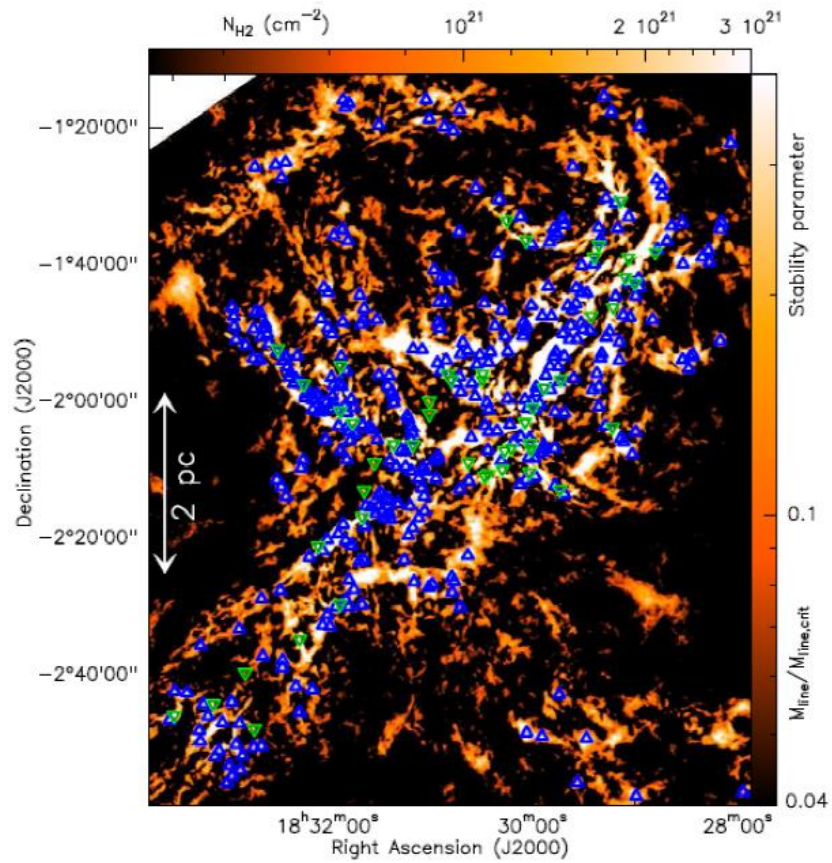
- ダスト成長の指標
- 観測で受かるレベルの偏光を予測
- Appendixに MCFOST, RADMC-3D, MCMax, TORUSの比較あり

# A census of dense cores in the Aquila cloud complex: SPIRE/PACS observations from the Herschel Gould Belt survey

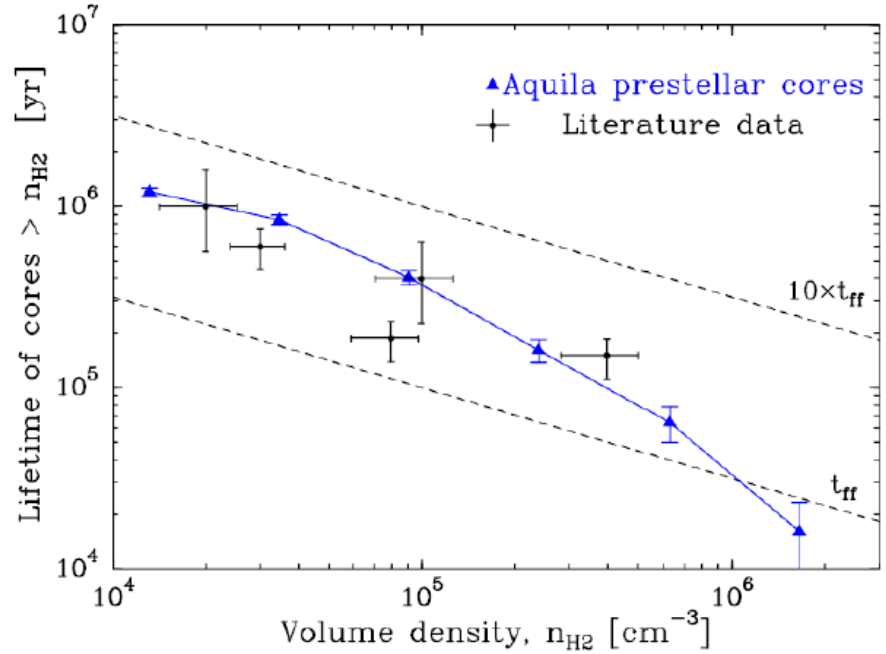
V. Koenyves, Ph. Andre et al.

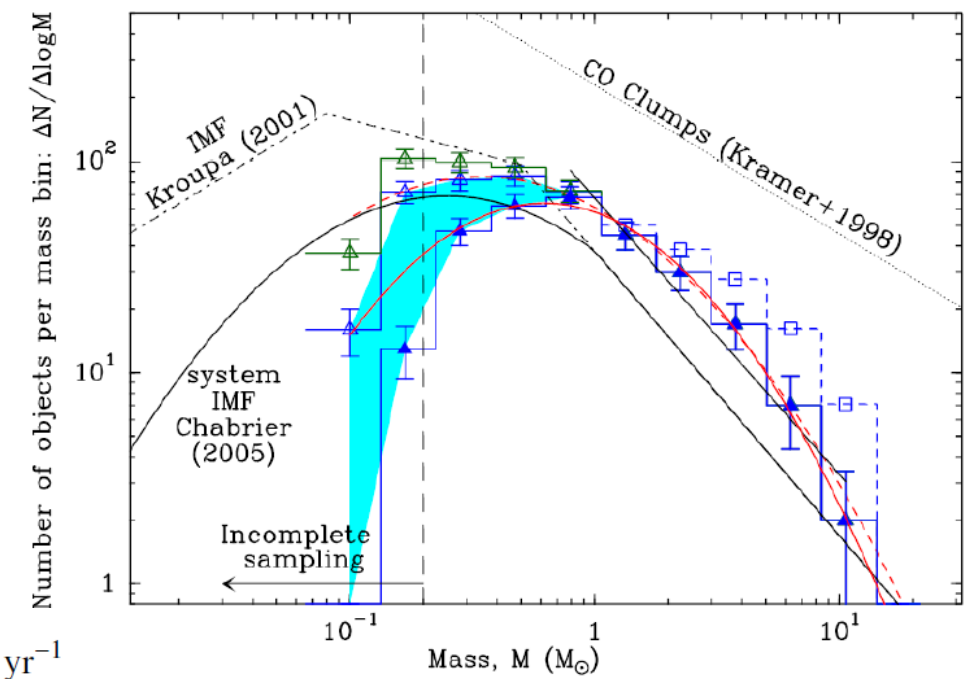
- Herschel による Aquila分子雲(d=260 pc)の 11平方度の観測から作成した”first generation catalog” について報告
- Starless dense cores, Class 0—1 のcompleteなサンプルを抽出し、それらの性質や空間分布を調べた
- Starless coresは651個。60%+/- 10%は重力的にboundされたprestellar cores



- CMFの形はIMFによく似ている。また、Mass scale は、（個々のコアに対しての）典型的な星形成効率~40%とconsistent.
- Prestellar cores の寿命は ~1 Myrで、これはcoreのfree fall timescaleのおよそ4倍長い。また、コアの平均密度が大きいほど短い。
- Prestellar coresの空間分布はdensest filamentsと強い相関を示す
- Herschelで見つかったprestellar coresの約90%は Av~7以上（はっきりしたthreshold）の場所に位置し、約75%はフィラメント（super critical masses per unit length >~16 M_sun/pc）の中にある。つまり、CMFのピークを作るようなコアは、主に marginally supercritical filamentsの分裂でできるという描像を支持。
- Filamentにおけるprestellar core形成の物理が、dense gas での quasi-universal な星形成効率を決めているのだろう。



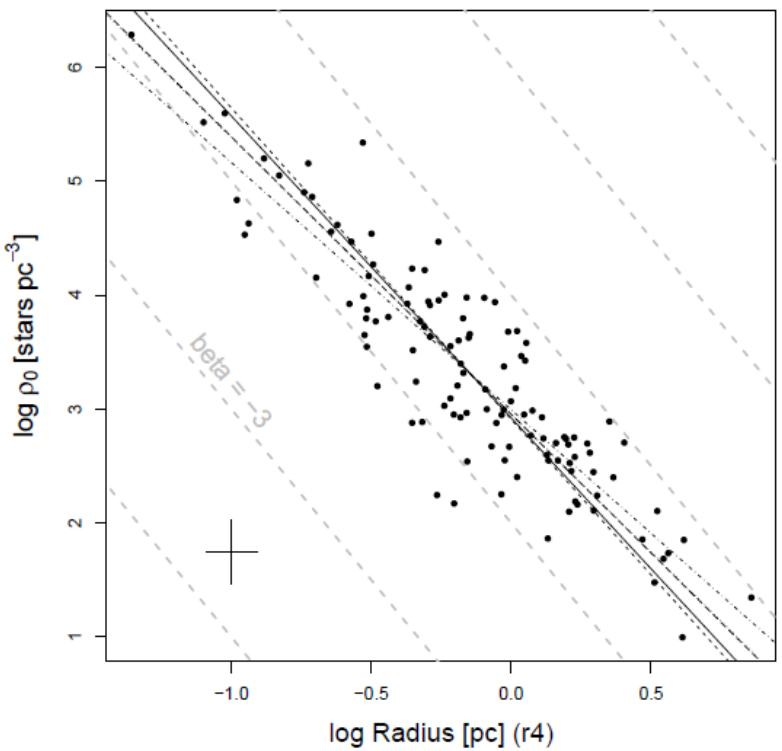

$$\mathrm{SFR}/M_{\mathrm{dense}} = f_{\mathrm{pre}} \times \epsilon_{\mathrm{core}} / t_{\mathrm{pre}} = \frac{0.15^{+0.05}_{-0.05} \times 0.4^{+0.2}_{-0.1}}{1.2^{+0.3}_{-0.3} \times 10^{6}} = 5^{+2}_{-2} \times 10^{-8}\ \mathrm{yr}^{-1}$$

Filled blue triangles: 292 robust prestellar cores

# The Spatial Structure of Young Stellar Clusters. III. Physical Properties and Evolutionary States

Michael A. Kuhn et al.

- 最低1個のO型星を含む3.6 kpc以内の星団17個（142 subclusters）を対象とした多波長観測プロジェクトMYStIX.
- Subclusters の形態(simple, core-halo, clumpy, chains)、サイズ、形状(ellipticity)、星の数、星の密度（surface & volumn)、分子雲による吸収の指標、年齢がテーブルに提供されている（カタログについてはpaper Iも参照）。
- 上記パラメータどうしの相関を調べる
  - 年齢とともに拡がる。Expansion rate は～1 km/s. 星形成領域の典型的な速度分散が ～3 km/s だとすると、重力的に束縛されていると考えられる。
  - 中心の密度(per volumn)と星団半径との関係は、∝r^{-2.3}。これは、一様に広がる星団モデルで予想されるー3乗よりもべきがゆるい。Subcluster の合体によって（エネルギー保存のため）拡散が促されているのではないか。




- Subclusterどうしの階層的な合体が初期の星団進化に重要なら、力学的緩和も速くなるのではないか。

# Period change of massive binaries from combined photometric and spectroscopic data in Cygnus OB2

Jaan Laur et al.

- 大質量星はほとんどが連星
- (1) 連星間での質量交換や(2)stellar wind による質量損失により、質量が変化する可能性がある
- 質量変化は軌道変化を引き起こすはず
- Cyg OB2にある7個のバイナリをモニタ
- 自分たちの測光データ（高橋20cm）＋アーカイブデータ（測光、Radial velocity）
- 通常は食のbrightness minimumで軌道の変化を調べるが、ライトカーブ全体を使ったモデルフィットを行った
- 4システムで、質量の時間変化の兆候(2 sigma)が見られた

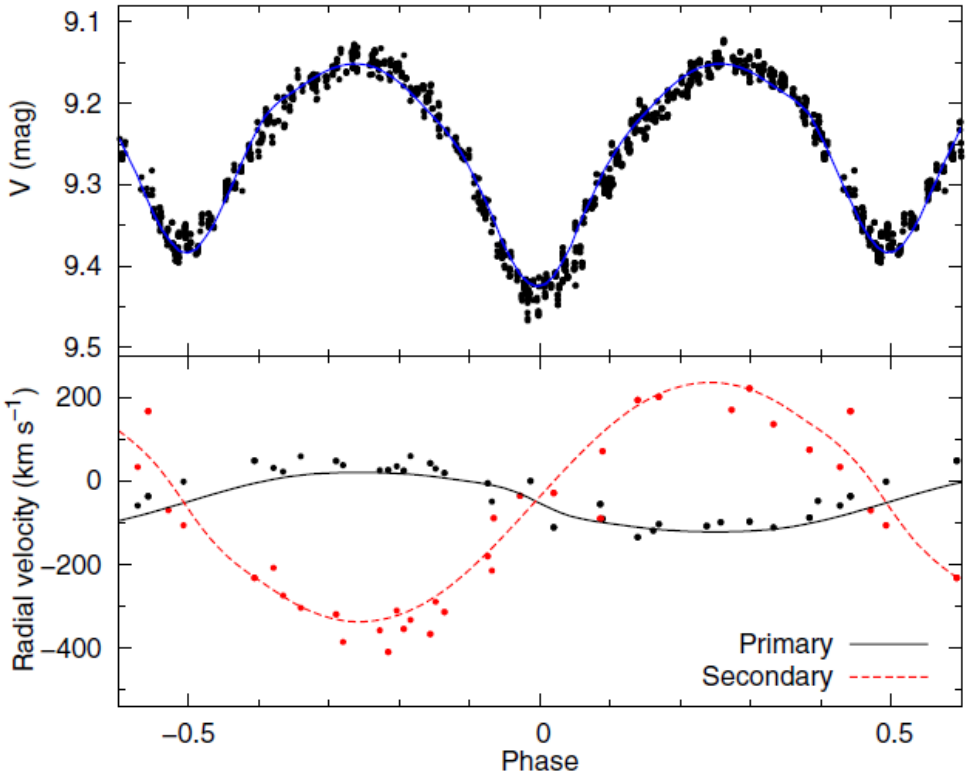


**Table 3.** Binary parameters from the PHOEBE modelling software.

| Parameter | A36 | B17 | MT059 | MT696 | MT720 | Schulte 3 | Schulte 5 |
|---|---|---|---|---|---|---|---|
| $M_1$ ($M_\odot$) | 22.41 ± 2.96 | – | 21.23 ± 6.24 | 14.00 ± 0.81 | 18.52 ± 1.51 | 32.73 ± 7.04 | 38.18 ± 5.21 |
| $M_2$ ($M_\odot$) | 15.32 ± 2.02 | – | 6.22 ± 1.83 | 12.67 ± 0.73 | 13.19 ± 1.07 | 17.21 ± 3.70 | 10.24 ± 1.40 |
| $q$ | 0.68 ± 0.04 | – | 0.29 ± 0.01 | 0.91 ± 0.03 | 0.71 ± 0.03 | 0.53 ± 0.05 | 0.27 ± 0.03 |
| $R_1$ ($R_\odot$) | 16.08 ± 0.27 | – | 12.51 ± 0.10 | 5.92 ± 0.09 | 9.93 ± 0.59 | 18.40 ± 0.41 | 27.16 ± 0.34 |
| $R_2$ ($R_\odot$) | 13.48 ± 0.30 | – | 5.89 ± 0.21 | 5.63 ± 0.09 | 8.47 ± 0.38 | 13.50 ± 0.34 | 15.15 ± 0.20 |
| $T_1$ (K) (fixed) | 27 000 | – | 38 000 | 32 000 | 29 800 | 41 200 | 36 100 |
| $T_2$ (K) | 22 924 ± 38 | – | 18 966 ± 98 | 31 070 ± 25 | 19 202 ± 80 | 29702 ± 37 | 23 681 ± 112 |
| $i$ (°) | 71.76 ± 0.11 | – | 68.18 ± 0.13 | 81.87 ± 0.06 | 71.09 ± 0.28 | 57.47 ± 0.09 | 64.65 ± 0.05 |
| $a$ ($R_\odot$) | 39.43 ± 1.45 | – | 36.34 ± 3.46 | 16.23 ± 0.24 | 35.52 ± 0.78 | 43.72 ± 2.63 | 53.90 ± 2.08 |
| $e$ | 0.01 ± 0.001 | – | 0.14 ± 0.002 | 0 (fixed) | 0.34 ± 0.005 | 0.015 ± 0.001 | 0 (fixed) |
| $\omega$ (°) | 350 | – | 189 | 0 (fixed) | 298 | 0 | 0 (fixed) |
| Spectral class | B0Ib+B0III | O7:+O9: | O8V+B | O9.5V+B0V | B0-B1V+B1-B2V | O6IV:+O9III | O7Ianfp+Ofpe/WN9 |

**Notes.** Parameters in this table are the primary and the secondary component masses ($M_1$, $M_2$), the mass ratio $M_1/M_2$ ($q$), the primary and the secondary component radii ($R_1$, $R_2$), the primary and the secondary component temperatures ($T_1$, $T_2$), the inclination angle ($i$), the semi-major axis ($a$), the eccentricity of the system ($e$), the argument of periastron ($\omega$), and the binary spectral classes that are taken from Kobulnicky et al. (2014). The temperature for the primary component was fixed according to the spectral class (Gray 2001).

**Table 4.** Mass transfer and mass loss through stellar wind rates for our selected stars.

| Star | Used $\dot{P}$ value | $\dot{M}_1$ mass transfer ($10^{-6}$ $M_\odot$ yr$^{-1}$) | $\dot{M}_1$ stellar wind ($10^{-6}$ $M_\odot$ yr$^{-1}$) |
|---|---|---|---|
| A36 | $\dot{P}_{\rm emp}$ | 48 ± 19 | −56 ± 19 |
| | $\dot{P}_{\rm model}$ | 50 ± 21 | −58 ± 19 |
| MT059 | $\dot{P}_{\rm emp}$ | −10.5 ± 4 | – |
| | $\dot{P}_{\rm model}$ | −8.0 ± 3 | – |
| MT696 | $\dot{P}_{\rm emp}$ | −41 ± 160 | – |
| | $\dot{P}_{\rm model}$ | −50 ± 254 | – |
| MT720 | $\dot{P}_{\rm emp}$ | 104 ± 30 | −10.7 ± 4.2 |
| | $\dot{P}_{\rm model}$ | −149 ± 45 | – |
| Schulte 3 | $\dot{P}_{\rm emp}$ | −13.9 ± 10.2 | – |
| | $\dot{P}_{\rm model}$ | 0.001 ± 8.8 | – |
| Schulte 5 | $\dot{P}_{\rm emp}$ | 3.0 ± 0.2 | −15.6 ± 0.7 |
| | $\dot{P}_{\rm model}$ | 3.4 ± 0.2 | −17.4 ± 0.8 |

**Notes.** No mass loss through stellar wind is given for the negative $\dot{P}$ value as this would indicate a positive mass loss from the primary. The errors are calculated using the $P$, $\dot{P}$, $M_1$, and $M_2$ uncertainties. The errors for MT696 are large as a result of the similar companion masses. The two period change values ($\dot{P}_{\rm emp}$ and $\dot{P}_{\rm model}$) for each star are given in Table 2. B17 is omitted from the table as there are no mass estimates.

# The structure of the Cepheus E protostellar outflow: The jet, the bowshock, and the cavity

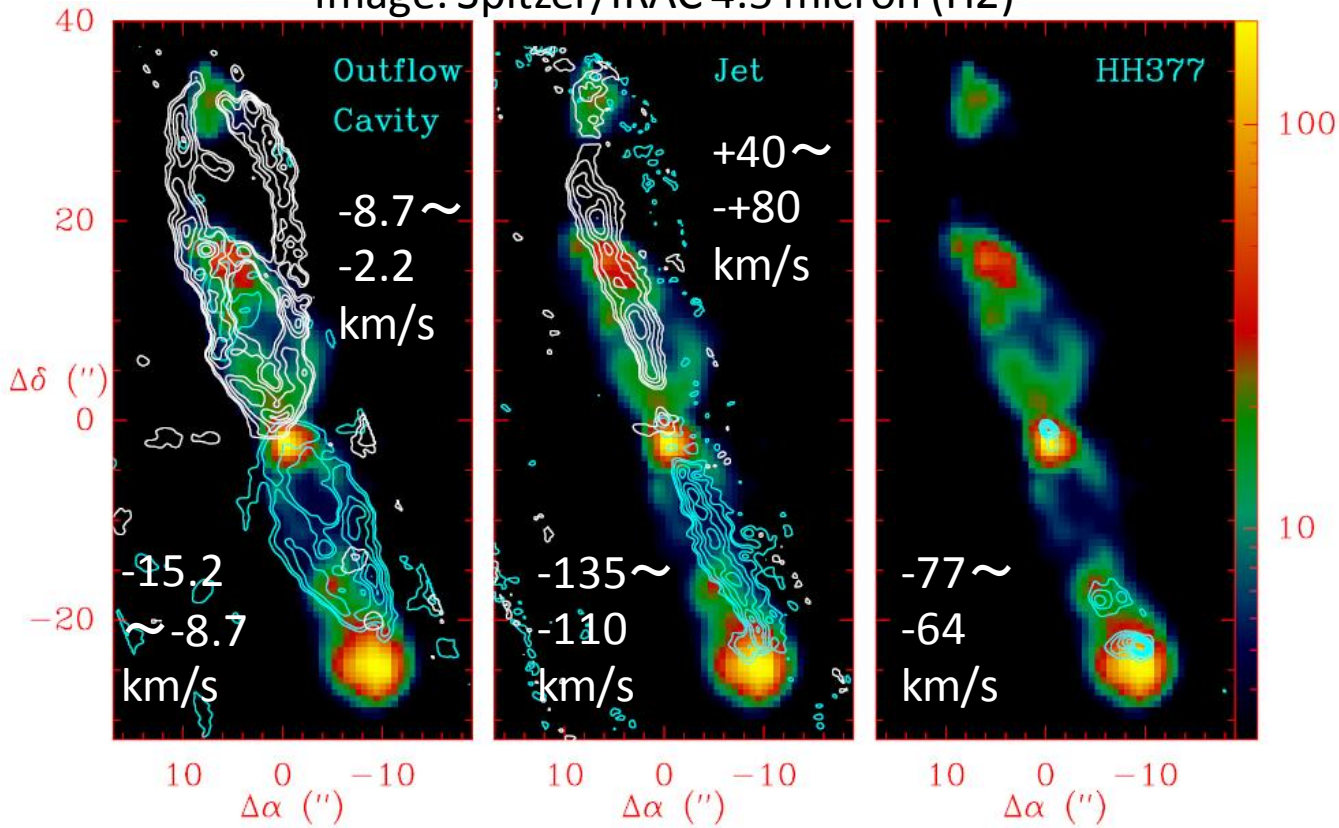
B. Lefloch et al.

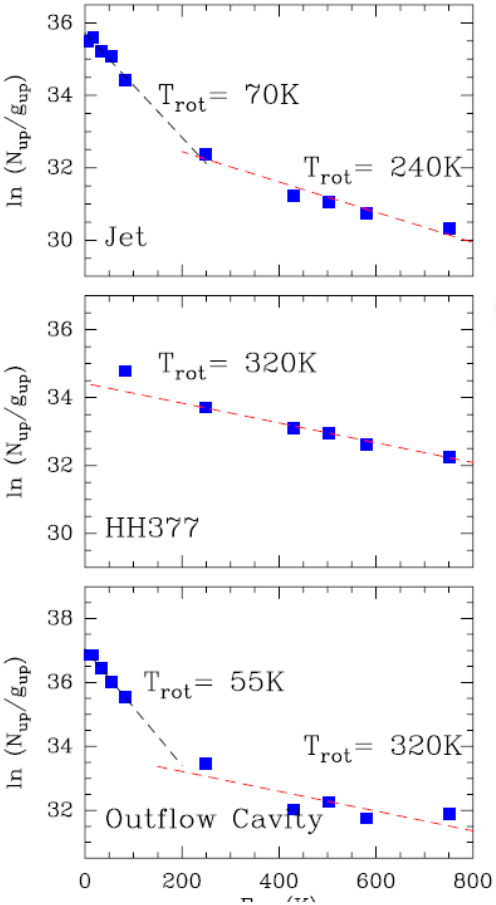
- Generally, high-J study is rare for protostellar outflow
- Cep E-mm (100 L_sun), well studied Class 0
  - High-J data exists (ISO, SOFIA), but with low angular resolution

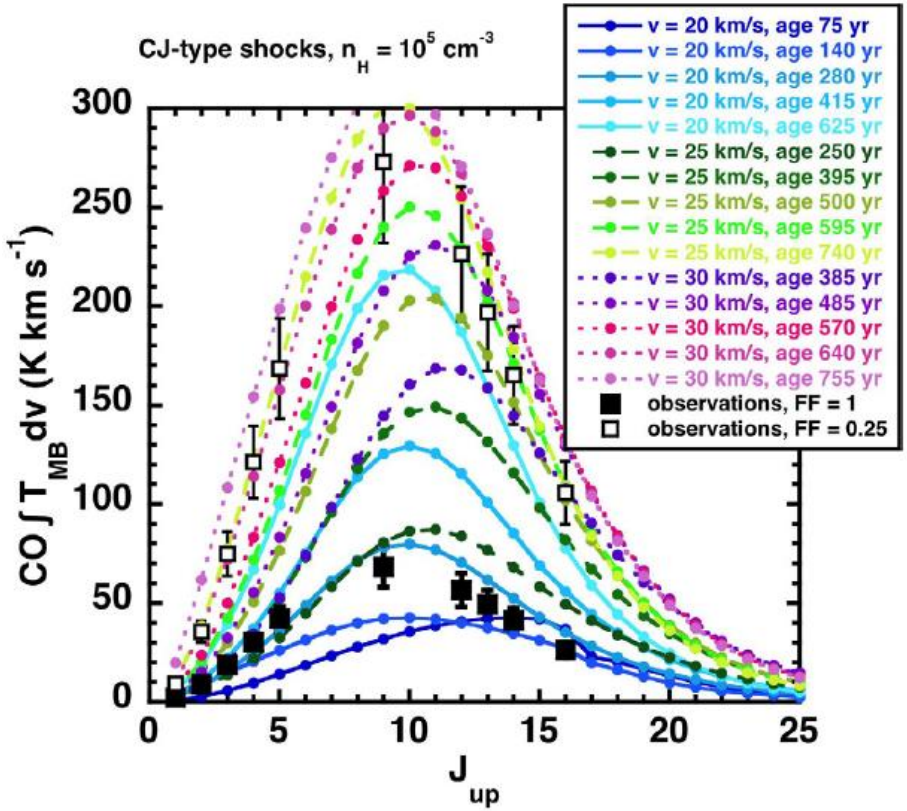
- Multi-transitional study
- IRAM: J=1—0
- PdBI: J=2—1
- JCMT: J=3—2, 4—3
- Herschel: J=5—4, 9—8, 14—13
- SOFIA: J=12—11, 13—12, 16—15

--- most complete coverage of the CO ladder at high spectral resolution

Contour: CO 2—1 with PdBI (1" resolution)
Image: Spitzer/IRAC 4.5 micron (H2)






- Jet, outflow cavity は同じ量の角運動量を運んでおり、jet bowshock driven outflow を示唆
- Hot CO gas が jetの中にも存在することは、20—30 km/s で進むCJ-shock を示唆

**Table 3.** Physical conditions ($n(H_2)$, $T_{kin}$, $N(CO)$) in the outflow cavity as a function of velocity between −14 and −50 km s$^{-1}$, as derived from our large velocity gradient analysis of the velocity-integrated CO line fluxes.

| Vel. range (km s$^{-1}$) | | −14; −17 | −17; −20 | −20; −25 | −25; −30 | −30; −35 | −35; −40 | −40; −50 |
|---|---|---|---|---|---|---|---|---|
| Low-excitation | $T_{kin}$(K) | 85 | 75 | 75 | 70 | 65 | 65 | 62 |
| | $n(H_2)$(cm$^{-3}$) | 0.8(5) | 2(5) | 1(5) | 2.7(5) | 4(5) | 6(5) | 8(5) |
| | $N(CO)$(cm$^{-2}$) | 2.0(17) | 1.0(17) | 8.5(16) | 5(16) | 3.5(16) | 2.5(16) | 3(16) |
| | $\tau^{12}_{54}$ | 2.9 | 1.5 | 0.90 | 0.50 | 0.35 | 0.25 | 0.15 |
| | $\tau^{12}_{21}$ | 0.9 | 0.50 | 0.27 | 0.18 | 0.13 | 0.09 | 0.06 |
| High-excitation | $T$ (K) | 750–1200 | 700–1200 | 700–1100 | 700–1100 | 850–1200 | 800–1500 | 1000–1500 |
| | $n(H_2)$(cm$^{-3}$) | (1–2)(6) | (1–3)(6) | (1–5)(6) | (1–5)(6) | (1–5)(6) | (1–3)(6) | (1–3)(6) |
| | $N(CO)$ (cm$^{-2}$) | 8(15) | 6.5(15) | 9(15) | 7(15) | 6(15) | 4.5(15) | 8.5(15) |