대덕전파천문대 안내

TRAO Information

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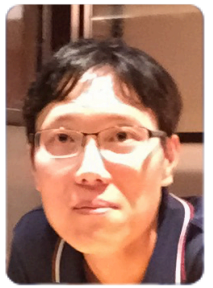

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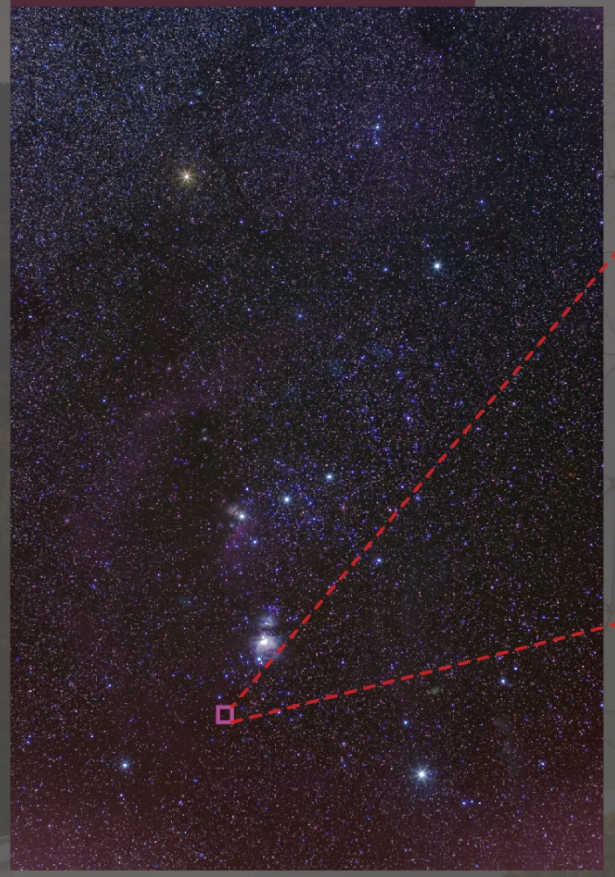
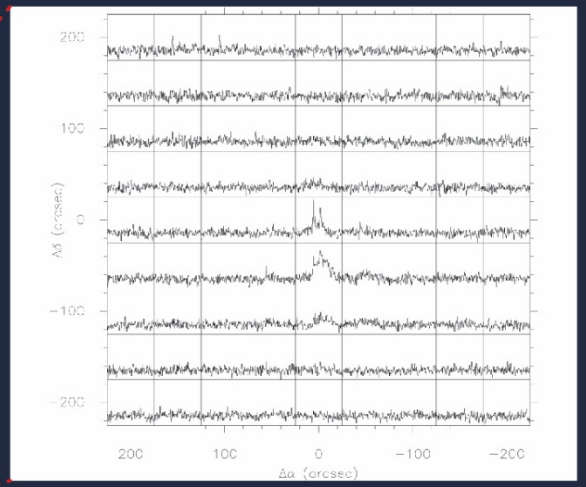
전파 관측 연구

〈 전파 관측 자료 처리 〉

광학망원경으로 관측한 오리온자리



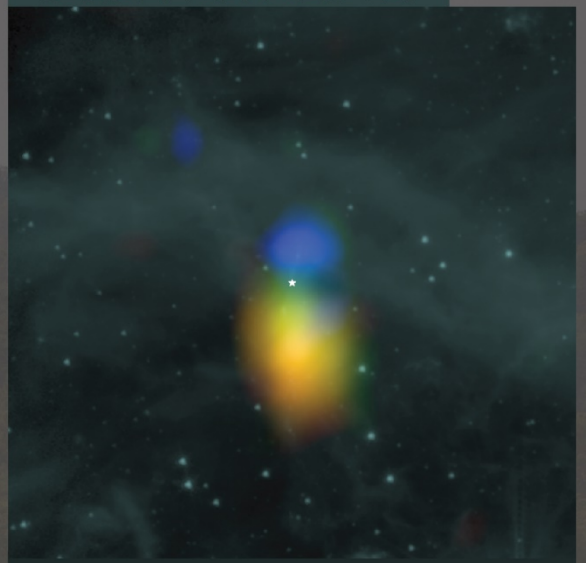
· TRAO로 관측한 V380 Ori NE 분출류



메탄올의 파장 3.1 mm 전파 방출선 스펙트럼.

관측된 전파 분광선은 속도와 밝기의 분포를 갖는 스펙트럼 형태로 얻어진다. 스펙트럼의 속도 구간별로 방출선의 세기를 측정하여 밝기 분포 영상을 만들고, 속도를 색으로 변환 및 합성하여 이미지 처리함으로써 천체의 운동을 연구할 수 있다.
관측된 스펙트럼의 선폭은 최대 36 km/s으로 아주 큰 값을 보이는데 이는 원시성의 제트 분출류가 분자 구름 안에 강한 충격파를 발생시켰다는 것을 알려준다.

전파데이터를 이미지 처리한 결과



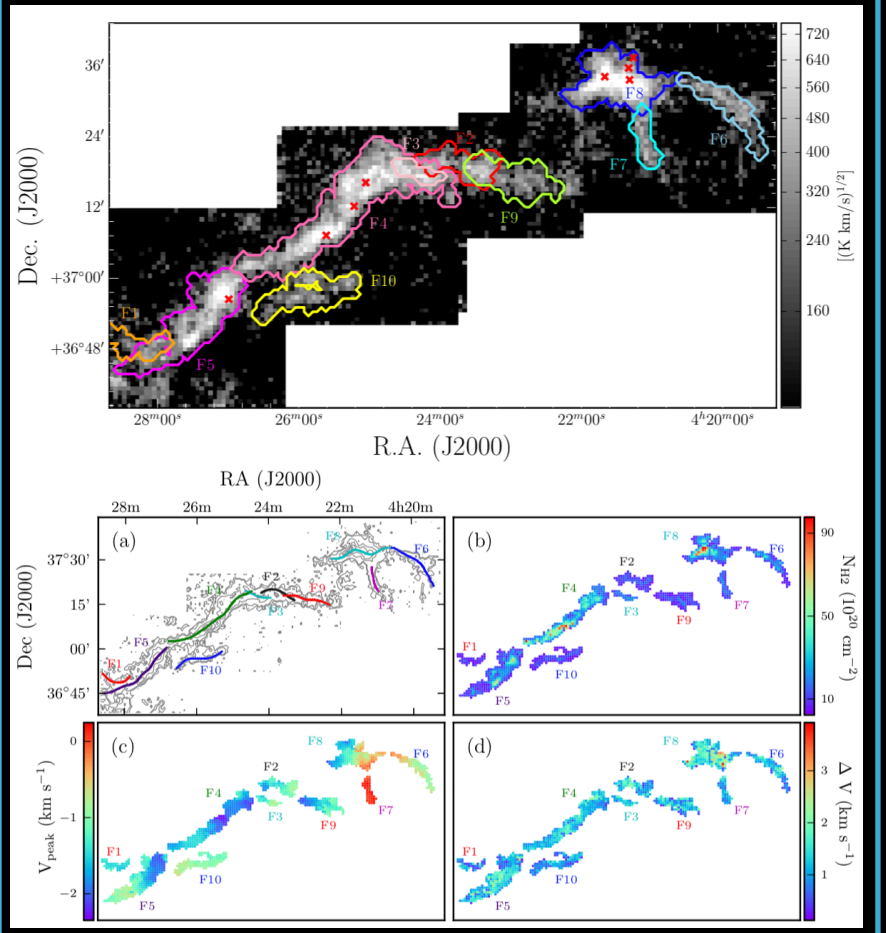
원시성에서 분출되는 제트에 의하여 발생하는 메탄올 가스 흐름의 분포.

파란색은 관측자 쪽으로 다가오는 가스, 빨간색은 멀어지는 가스를 나타낸다. 광학망원경으로 아무 것도 보이지 않는 암흑성운 내부를 전파망원경으로 관측하여, 활발한 별 생성 현상을 확인할 수 있다.

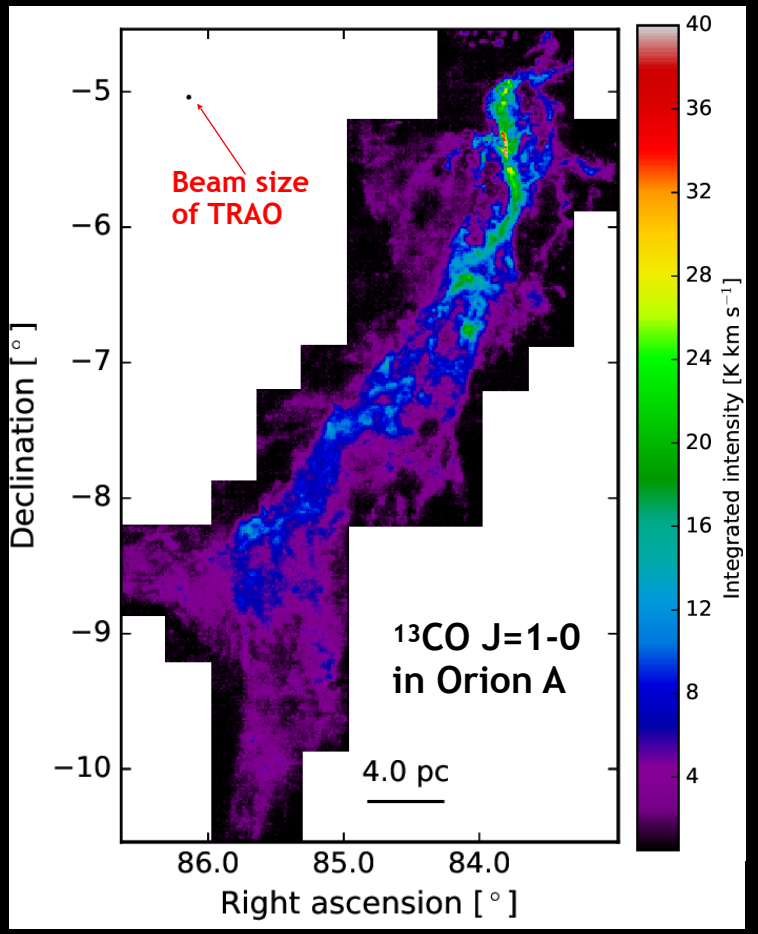
영상의 색 - 가스의 속도
흰색 별표 - 원시성이 있는 위치
청록색 배경 영상 - 적외선 사진

TRAO Key Science Programs

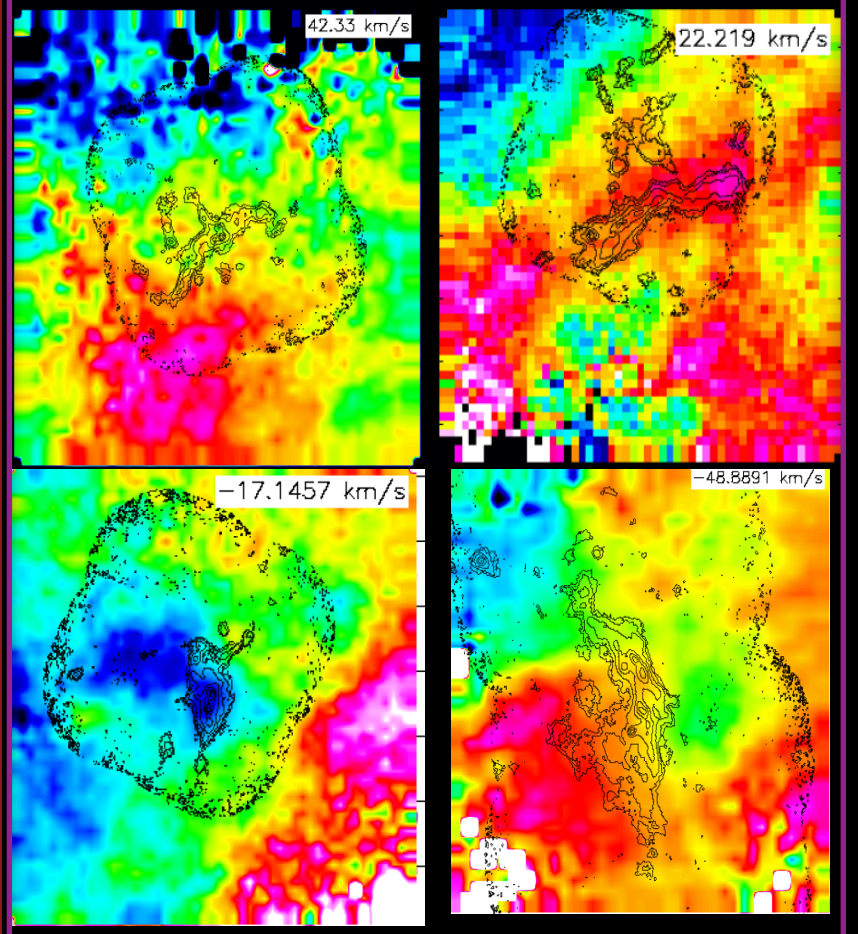
FUNS



TIMES

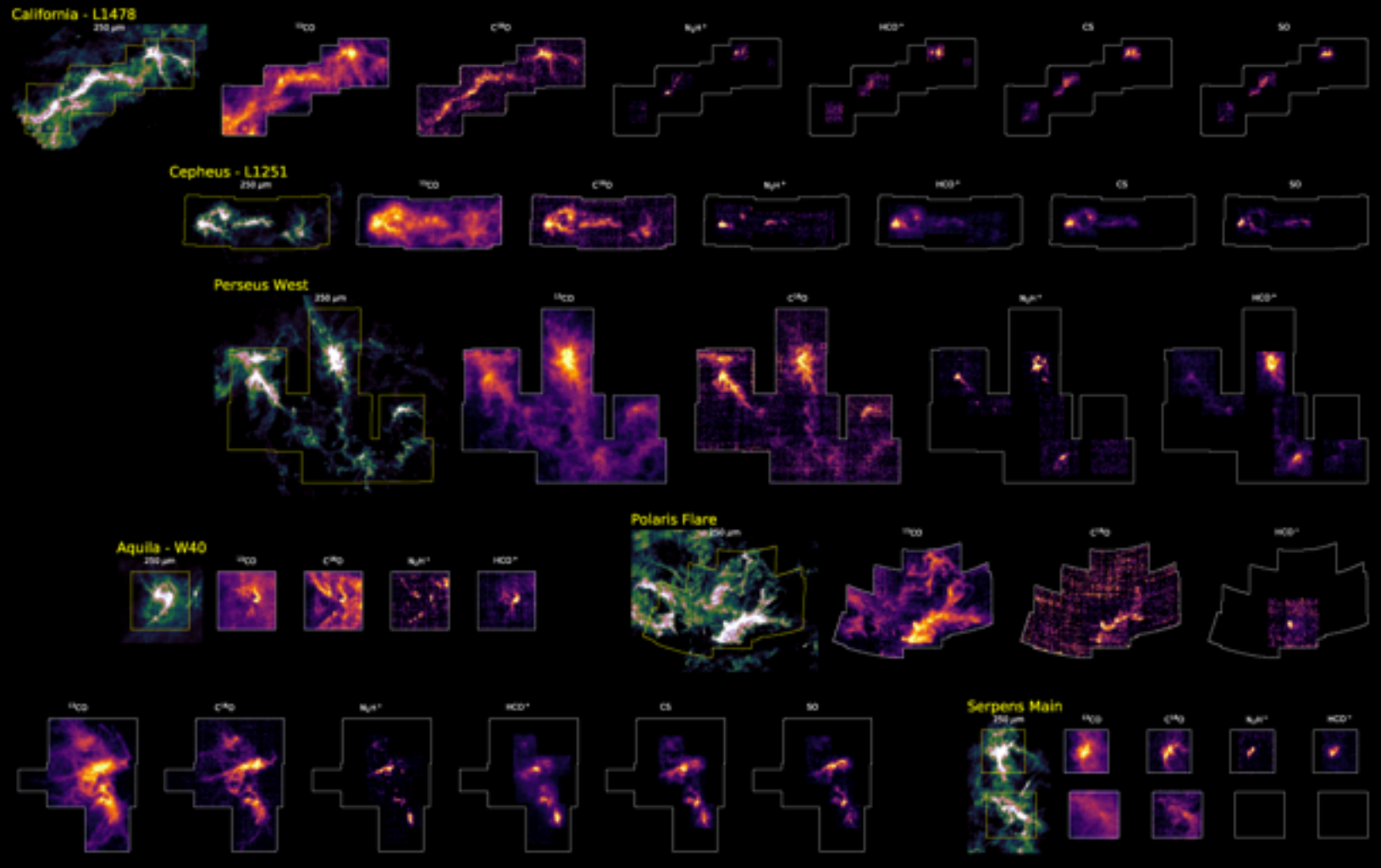


TOP



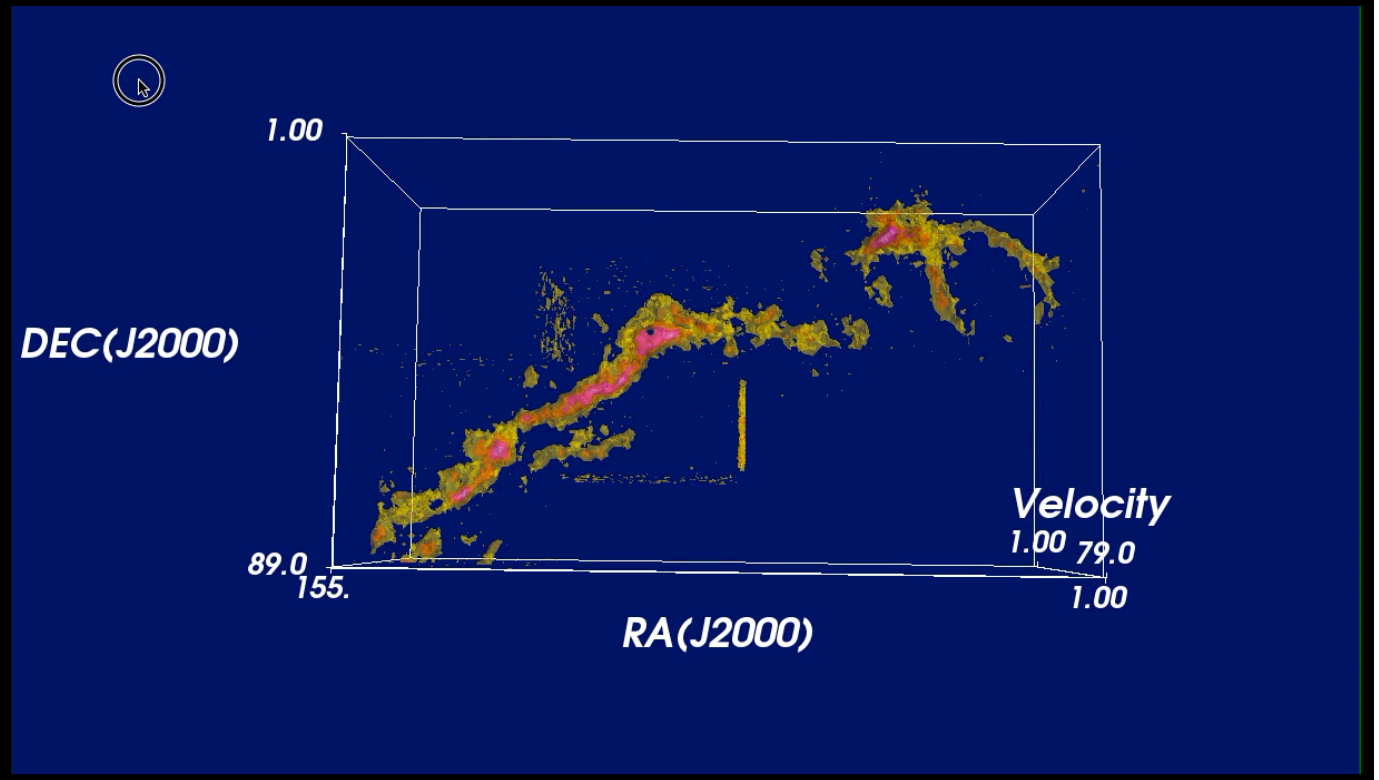
TRAO-FUNS Survey

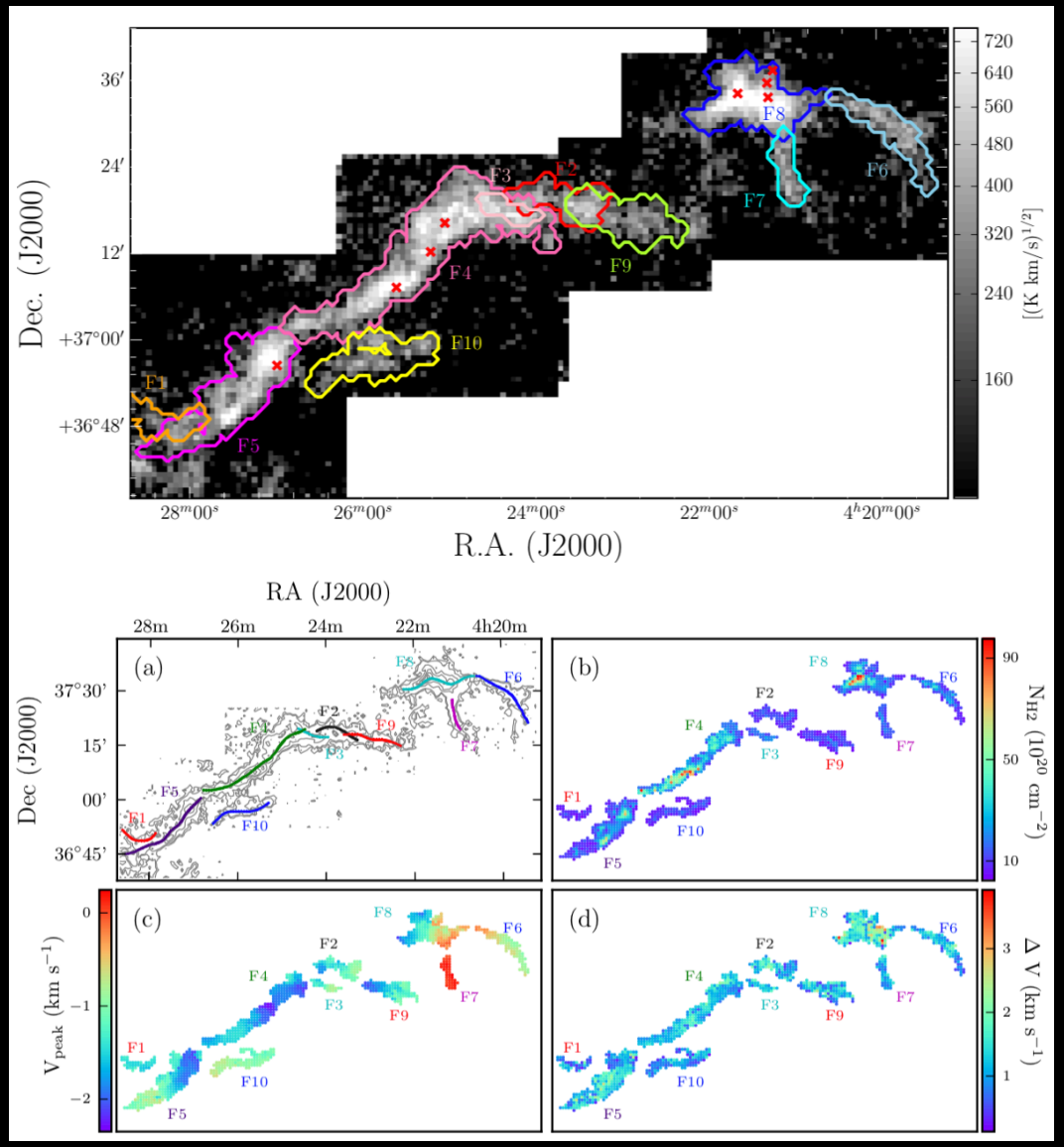
Herschel 250um with intensity integrated images of ^{13}CO, $C^{18}O$, N_2H^+, HCO^+, CS, and SO for 7 Molecular Clouds



30’

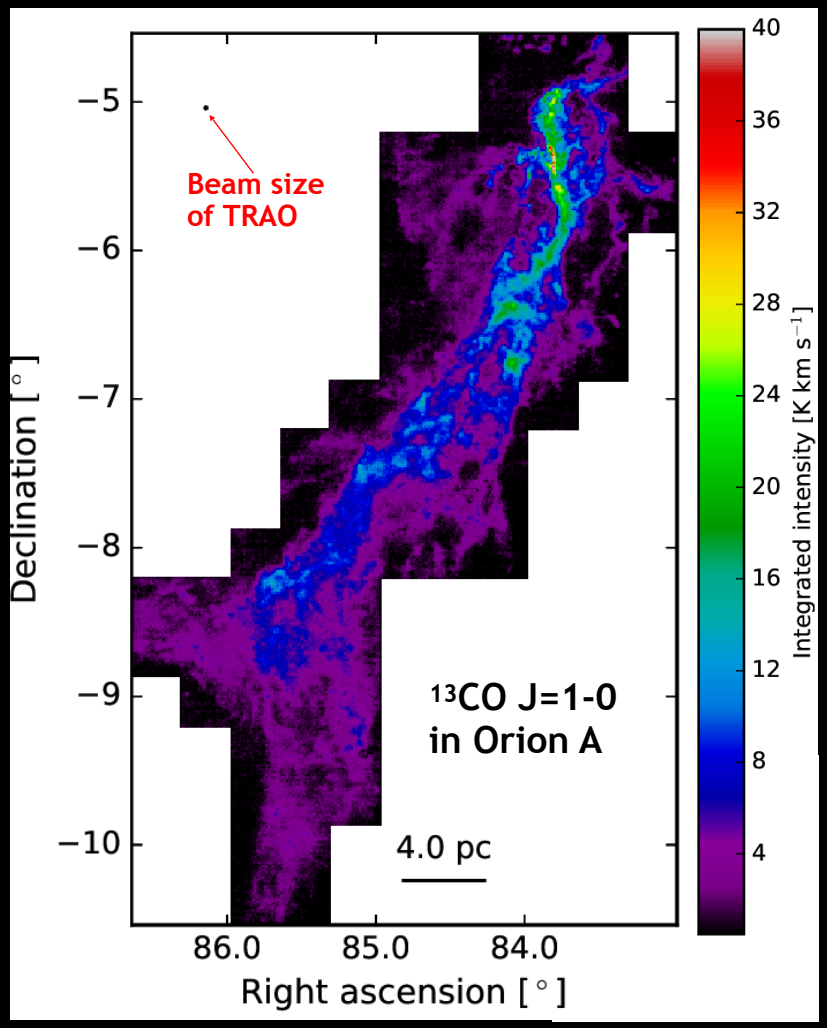
TRAO-FUNS L1478 관측결과





Chung et al. 2019

TIMES: mapping Turbulent properties In star-forming MolEcular cloud down to the Sonic scale

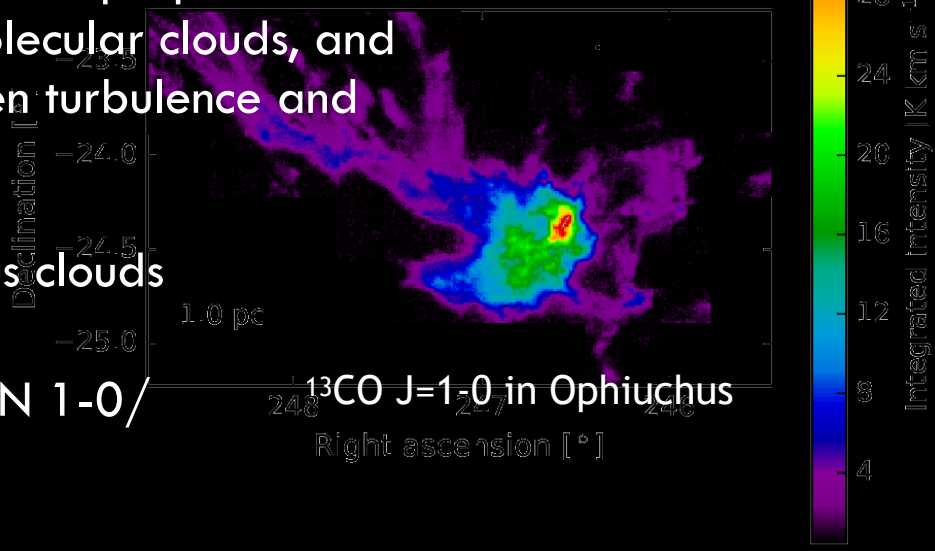


Members: Hyeong-Sik Yun[1], Jeong-Eun Lee[1] (PI), Yunhee Choi[1], Seokho Lee[1], Giseon Baek[1], Yong-Hee Lee[1], Minho Choi[2], Hyunwoo Kang[2], Keni'chi Tatematsu[3], Mark H. Heyer[4], Brandt A. L. Gaches[4], Neal J. Evans II[5], Stella S. R. Offner[5], and Yao-Lun Yang[5]
[[1]KHU, [2]KASI, [3]NAOJ, [4]UMASS, [5]UT]

Objective: Investigate the turbulent properties from two different star-forming molecular clouds, and understand a relation between turbulence and star-formation.

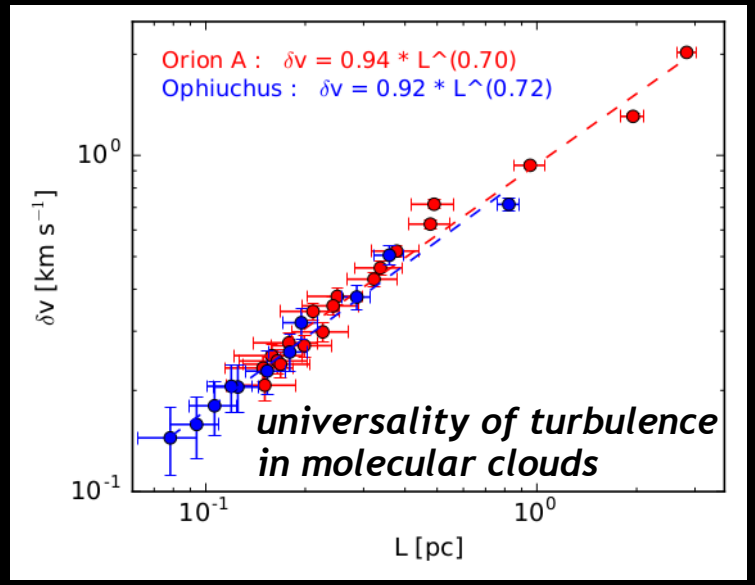
Targets: Orion A and Ophiuchus clouds

Lines: ^{13}CO 1-0/C^{18}O 1-0, HCN 1-0/ HCO$^+$ 1-0, N_2H^+ 1-0/CS 2-1

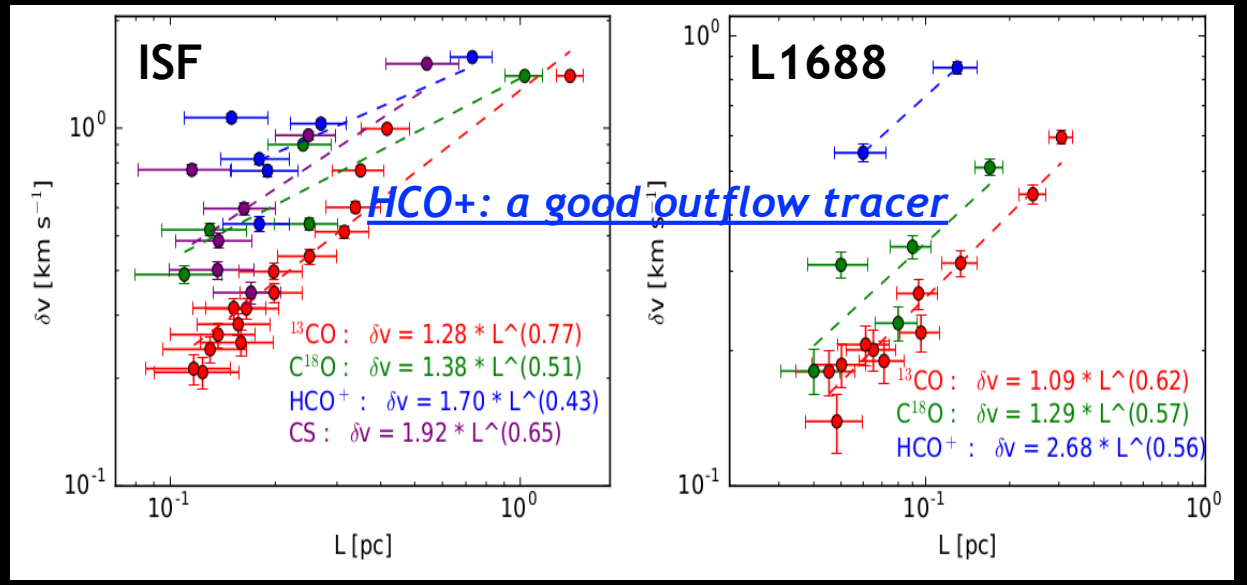


TIMES Principal Component Analysis

- A possible way to recover underlying turbulent power spectrum from the observed spectral cube data (Brunt & Heyer 2013)
- Determines the relation between the velocity dispersion (δv) and spatial scale (L) and converts to the power-law slope of turbulent power spectra (Brunt 1999, Brunt et al. 2003)
- PCA results for the active star-forming regions, the Integral Shape Filament (ISF) in the Orion A cloud and L1688 in the Ophiuchus cloud show the largest and smallest δv for a given L in HCO+ and ^{13}CO, respectively.



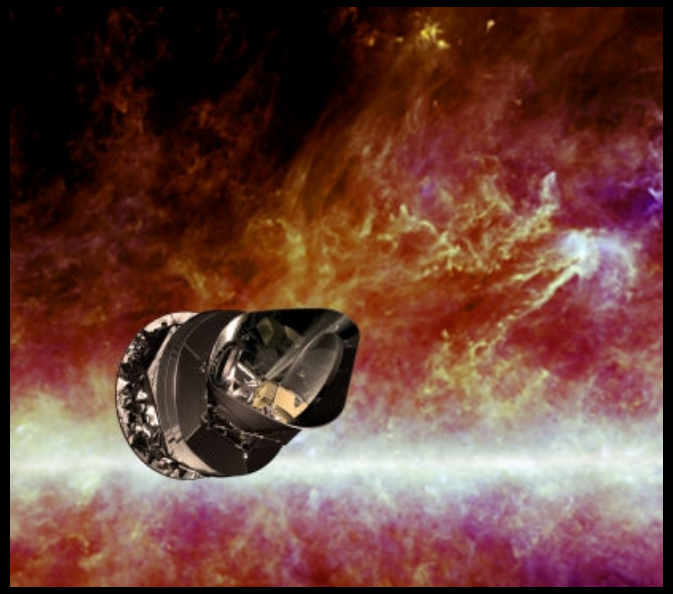
PCA results for ^{13}CO



PCA results for different transitions in ISF and L1688

➜ *star formation feedback on turbulence*

TOP: TRAO Observations of Planck cold clumps



Surveys of Planck Galactic Cold Clumps

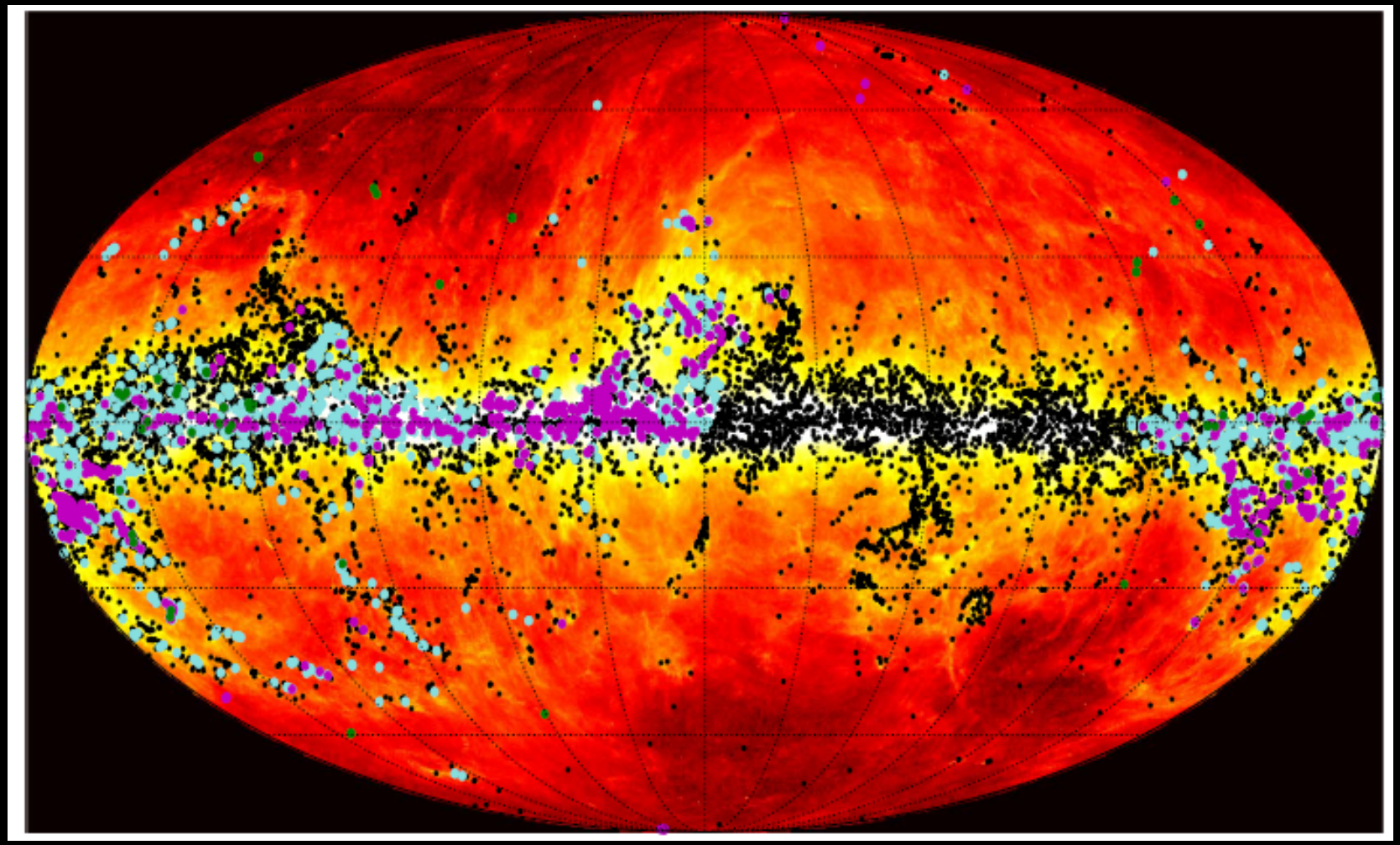
Planck is a third generation space based cosmic microwave background experiment, operating at nine frequencies between 30 and 857 GHz

Planck Catalogue of Galactic Cold Clumps (PGCC), *13188 clumps*

The PGCCs are cold (T_d~14 K) clumps and thus represent the very initial conditions of star formation and molecular cloud evolution

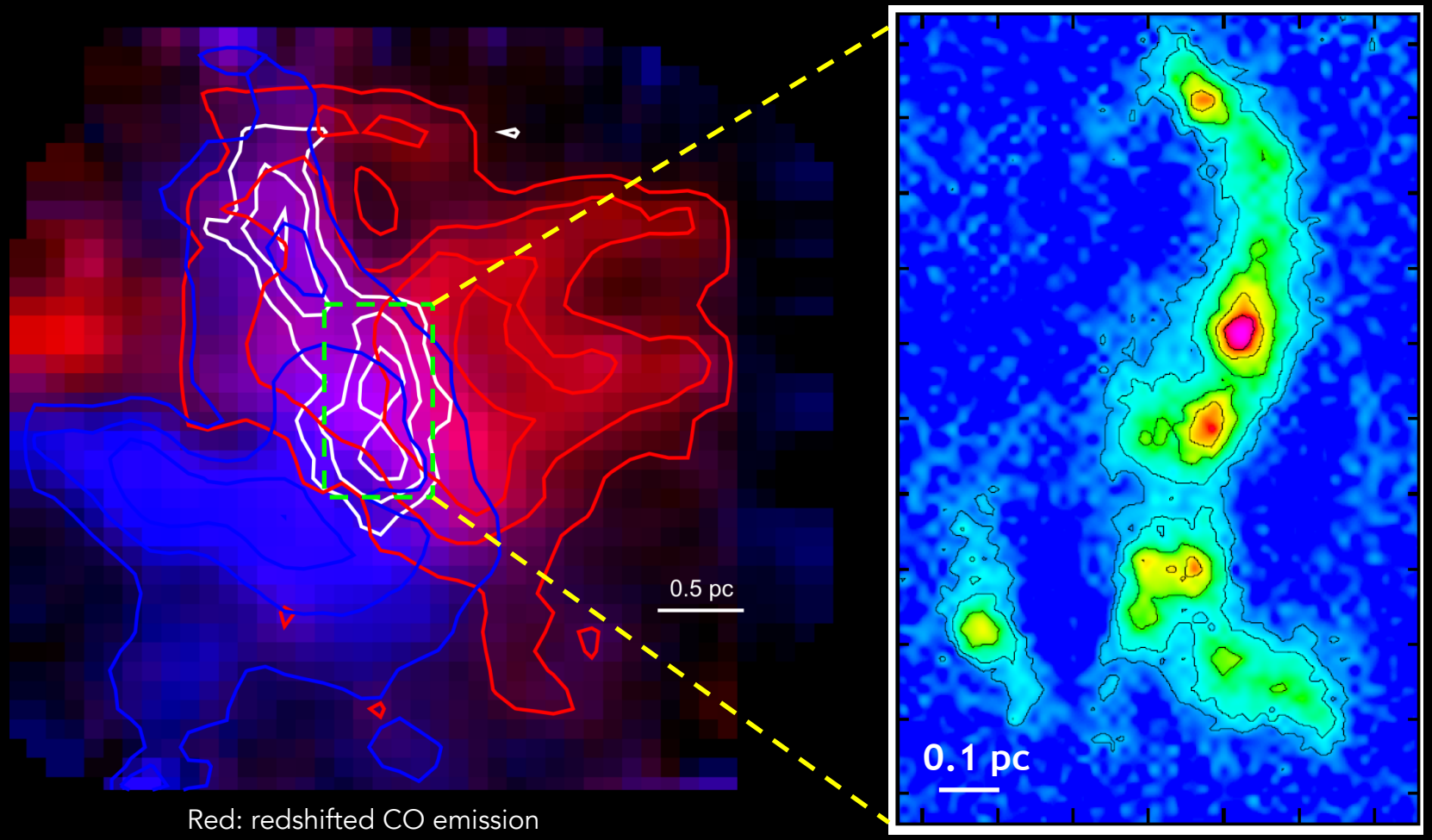
We have formed an international team that includes more than **150 experts** all over the word (China; Japan, S. Korea, U.K., Taiwan, U.S., Canada, France, Finland…) to follow-up observe **1000-2000** PGCCs with multiple state-of-the-art telescopes (**TRAO 13.7-m**, PMO 13.7-m, JCMT 15-m, NRO 45-m, SMT 10-m, KVN, IRAM 30-m, SMA, ALMA, SOFIA, BLAST-TNG, Effelsberg 100-m, TianMa 65-m, FAST 500m…) in order ***to investigate the initial conditions of star formation in widely different environments and to address the questions raised in the introduction part.***

TOP Survey



All-sky distribution of the 13188 PGCC sources (black dots), the 2000 PGCC sources selected for **TOP** (blue dots), and 1000 for SCOPE (pink dots) overlaid on the 857 GHz Planck map (Liu et al. 2018, ApJS, 234, 28)

TOP: Filament formed due to cloud-cloud collision?



Red: redshifted CO emission
Blue: blueshifted CO emission
White: $C^{18}O$ emission

SCUBA-2 850 micron continuum

Zhang et al. 2019; more examples in Dana et al. 2019; Liu et al. 2018b, ApJ, 859, 151