Stars form in the densest parts of molecular clouds, the so-called prestellar cores. However, the formation and spatial distribution of prestellar cores in different kinds of molecular clouds is far from well known due to the lack of an “all-sky” census. The important connection between core formation and the hierarchical fragmentation of molecular clouds remains obscure. Now, the Planck telescope has provided us with an unprecedented sample of “all-sky” pre-stellar object candidates. Planck cold clumps correspond to the coldest portion of the ISM where stars form, and can be used to characterize the earliest stages of star formation.

In order to make significant progress in understanding the early evolution of molecular clouds and dense cores in a wide range of Galactic environments, we are carrying out unbiased “all-sky” continuum and molecular line surveys of -1000-2000 Planck cold clumps with ground-based telescopes (TRAO, JCMT/SCUBA-2, SMT, KVN...).

Through these extensive surveys, we aim to answer:
1. how dense cores form and how star formation varies as a function of environment,
2. the universality of filaments in the cold ISM and their roles in generating dense cores,
3. the existence of a density threshold for dense core formation,
4. how dust properties change in different environments, and how dust properties affect the chemical evolution of dense cores.

**Surveys**

1. **TOP**: TRAO Observations of Planck cold clumps (400 hrs/yr for 3 years) Tracers: J=1-0 transitions of CO isotopologues
2. **SMT** 10-m telescope survey (PI: Dr. Ke Wang, 600 hrs/3yrs) Tracers: J=2-1 transitions of CO isotopologues
3. **SCOPE**: SCUBA-2 Continuum Observations of Pre-protostellar Evolution (300 hrs) Tracer: 850 micron continuum
4. **KVN** 21-m telescope survey (HCN, HCO+, N2H+): filler proposals accepted
5. **NH3** follow-up survey with Effelsberg 100-m and TianMa 65-m: in preparation
6. Hi 21 cm survey with FAST 500-m telescopes: in preparation
7. Follow-up observations with NRO 45-m (PI: Ken Tatematsu, ~200 hrs in 2015B) Tracers: CCS, N2H+, NH3, ...
8. Follow-up observations with the SMA: filler proposals accepted

**Telescopes**

- SEQIOIA
- TRAO
- SMT
- KVN
- JCMT
- SCUBA-2
- 100-m
- TianMa 65m
- FAST
- NRO 45-m
- SMA

**Preliminary Results**

1. **SCUBA-2 850 micron images Gallery**

   We discovered an extremely young class 0 source (G192N) and a proto-brown dwarf candidate (G192S) in PGCC 192.32-19.88. The black contours and color images in the three panels show SMA 1.3 mm continuum. The CO outflows are shown in red and blue contours in the middle and right panels. 

   - G192N: M=0.43 M⊙
   - G192S: M=0.23 M⊙

   For details see Liu et al. 2016, ApJS, 222, 7

2. **PGCC 192.32-19.88**

   We observed 14 PGCCs in the LMC with PMO 13.7 telescope. Those PGCCs show clear velocity (left panels) and temperature (right panels) gradients, indicating that they are externally compressed and heated by the HII region. Follow-up JCMT/SCUBA-2 observations could not detect dense cores in them, indicating the stellar feedback may have negative effects on core formation.

   - M=0.02 M⊙

3. **Stellar feedback and filament-filament collision**

   We detected two long (~10 pc) and wide (~1-2 pc) filaments in PGCC G074.1+00.1 from 13CO (1-0) emission as shown in the upper-left panel. Clear velocity gradient along the filaments are seen from the position-velocity diagrams of 13CO (1-0) emission (Lower panels). JCMT/SCUBA-2 observations reveal fine filaments connected to the central massive cluster forming region (Upper-right panel).

   - Lint=0.2 L⊙; accretion rate: 2.8e-8 M⊙/yr

4. **Core evolution in PGCC G207.3-19.8**

   As shown in the upper-left panel, Herschel observations (black contours) reveals two regions in PGCC G207.3-19.8. The southern region has much larger (HCO+/N2H+) ratio and CO abundance than the northern region, indicating that the southern region is more chemically evolved. The two regions are highly fragmented seen in 850 micron continuum from SCUBA-2 observations (Lower panels). Except HH 58 core, the other cores detected by SCUBA-2 are starless and gravitationally bound, suggesting that they are good prestellar core candidates. However, the starless cores seem to have very various density profiles, indicating that they may be at different evolutionary stages. We will characterize their evolutionary stages from NRO 45-m observations.