

平成()年度国立天文台滞在型共同研究報告書
Activity Report for NAOJ Visiting Joint Research in FY (2018)

年 月 日
2019/03/23

申請者 Applicant	氏名 Name	Patricio Sanhueza
	所属・職 Division・position	ALMA Project. Project research fellow
研究課題名 Research Title	ALMA Large Program. ALMA-IMF: ALMA Transforms Our View of the Origin of Stellar Masses	
研究場所 Place	Mitaka Campus	
共同研究者 氏名・所属・職名 Joint researcher's Name ・Institution・Position/ Graduate Student year	Hong-Li Liu. Universidad de Concepcion. Postdoc.	
1・研究概要 (Summary of research)		
<p>As part of an original and ambitious project, we proposed to reveal the origin of the initial mass function (IMF) and the physical processes that shape its precursor, the core mass function (CMF). For this purpose, an ALMA Large Program led by 4 PIs (Sanhueza is the PI from East Asia) from different nations was approved with the highest priority (ALMA-IMF). Dr. Hong-Li Liu visited NAOJ as a representative from one of the regions involved in the project (Chile). In this ALMA Large Program, we will derive the CMF on 15 massive protoclusters, by detecting thousands of cores. We aim to follow the evolution in time of the CMF/IMF relationship in these massive protoclusters and explain it through the quantification of gas inflows toward and outflows from detected cores. It is in this specific last point that Dr. Hong-Li Liu and I planned to work together. Dr. Hong-Li Liu is an expert in the formation and evolution of filamentary molecular clouds and their connection to star-forming cores, by using detailed analysis of kinematics. According to the development of ALMA-IMF, careful calibration and imaging, as also delay in the observations, it was necessary to make some small modifications to the original plan, without changing the final goal. The visit was productive and we moved forward in the project.</p>		

2. 研究成果(Research achievements)

The ALMA-IMF program includes the observations of 15 massive protoclusters in two ALMA bands at 1 and 3 mm. The data sets consist of mosaics of 12m, 7 m, and TP observations.

- Not all data was delivered as expected by December 2018. Some data sets were delivered just before the visit of Dr. Hong-li Liu.
- Therefore, it was necessary to work on the calibration of the data during the visit of Dr. Liu. Fortunately, the calibration did not take long and we finished the data sets assigned to EA and Chile during Dr. Liu stay.
- We made images of filaments and explore different cleaning parameters. N₂H⁺ J=1-0 more clearly delineated the dense filaments than C₁₈O J=2-1, which shows rather diffuse emission.
- N₂H⁺ emission reveals a complex network of filaments that connect at the center in hubs. In the hubs, high-mass star formation is going on.
- Velocity gradients are evident and likely hint to accretion from the outskirts of the clouds to the inner hub-systems.
- We made images of the continuum emission in band 6 (~220 GHz). We estimate that over 200 cores are detected above the 5sigma threshold.
- After analyzing the most massive cores, one by one, we identified high-mass prestellar candidates that show no association with Spitzer compact sources, hot core lines, and outflow activity. These prestellar, high-mass core candidates are key to define the initial conditions of high-mass star formation and constrain theory.

3. 本制度に対する意見、要望など【申請者記載欄】

(Any comments on this program【For applicant】)

The program allowed us to move faster on the analysis of the ALMA-IMF data and created new collaborations. I would thus conclude that the visit was successful.

4. 本制度に対する意見、要望など【本事業で来訪した共同研究者記載欄】

(Any comments on this program【For joint researcher】)

The program is beneficial to enhance international collaborations and I am happy to have been awarded. The program gave me a chance to present my research in a seminar, talk with Japanese scientists about my research, and create new collaborations.

5. 共同研究者の滞在日程(Joint research period)

氏名・所属 (Name・Institution)	Hong-Li Liu	
滞在日程 (Period of stay)	日数(days)	
年 月 日 ~ 年 月 日 2019/02/02 ~ 2019/03/01	27 間(days)	
年 月 日 ~ 年 月 日 YYYY/MM/DD ~ YYYY/MM/DD	日間(days)	
合 計 (Total)	27 間(days)	

(記載要領) (notes)

※ 記入欄は必要に応じ適宜スペースを拡張して記入のこと。

Fill out extending the entry columns as necessary

※ 共同研究者の滞在日程は、必要に応じ行を追加して記入、複数人招へいしている場合には、表をコピーして各人ごとに記載すること。

Fill out adding extra lines as necessary. If you invited multiple joint researchers, complete a copy of the table for each person.

※ 報告書の公開にあたり支障を生ずるおそれがある場合は、当該部分とその理由を明記すること。

When there is concern that making parts of this report public might cause difficulties, please indicate which parts and the reasons.

【お願い(Request)】

滞在終了1年後、当該共同研究によって出版された論文等の成果の提出を依頼させていただきますので、その際にご協力ください。

After a year following the completion of the research, we will send you a request to submit a list of papers and other results that have been produced by this research collaboration. We appreciate your cooperation.