



Comisión Nacional de Investigación
Científica y Tecnológica - CONICYT

Resultados Concurso Apex 2015-B

Propuesta: 2015B/006

Investigador Principal: Koraljka Muzic, Universidad Diego Portales

Título: A sensitive probe of gas in Lupus proto-planetary disks using CN

Resumen: We have obtained APEX data to do a pilot study to search for gas emission in a sample of protoplanetary disks in the Lupus molecular clouds, using the CN(3-2) line emission at 340 GHz as novel confusion-free probe of the kinematics of disks. Our main aim is to characterize the gas content of disks in the Lupus molecular clouds. The sample comprised eight T Tauris with strong continuum emission at 1.3 mm and with spectral types between K2 and M2. CN is a good tracer of the upper layers of the disk, where most other molecules are photodissociated. We report four (50%) new CN detections around dusty disks. Unfortunately in some cases the contribution from diffuse CN is ambiguous. We propose to obtain new CN(3-2) position-switching data using a different reference (off-) position than in our previous observations. These new data will give us much greater confidence that the emission is located in the stellar position, rather than diffuse background gas. Our data will allow us to constrain the gas content and kinematics, as well as to provide excellent candidates for follow-up with ALMA. Future ALMA images will allow to study the disk upper layers at high-resolution and sensitivity.

Tiempo asignado: 17 horas

Propuesta: 2015B/001

Investigador Principal: Guido Garay, Universidad de Chile

Título: SuperMALT: determining the physical and chemical evolution of high-mass star-forming clumps

Resumen: MALT90 recently surveyed ~3500 high-mass star-forming clumps within the Galaxy, obtaining small maps toward each clump in 16 spectral lines near 90 GHz. The low-J molecular transitions covered by MALT90 reveal the gas morphology, chemistry, and kinematics; however, alone, they are unable to constrain the physical properties of the clumps. In order to characterise the evolution of high-mass star-forming clumps, we now propose a large APEX program, SuperMALT, to observe the higher J transitions toward a carefully selected sub-sample of MALT90. In the first phase of this project we have completed the mapping toward all clumps in their (3-2) emission. Initial results show that the $J=3-2/J=1-0$ line ratios vary significantly among the clumps, suggesting a wide range of excitation conditions. These data suggest that gas temperatures and densities increase as the clumps evolve. We also see hint of chemical differences among the various evolutionary stages. Having demonstrated the feasibility and utility of SuperMALT, our current request is for 50 hours to begin the second phase of this project and observe the $J=4-3$ transitions, which will provide critical information about the denser and hotter gas within these clumps.

Tiempo asignado: 70 horas

Propuesta: 2015B/007

Investigador Principal: Lei Zhu, Universidad de Chile

Título: Global collapse during high-mass star formation: a mini survey

Resumen: How gas mass is converted into stellar mass is a fundamental question in the star formation process. A key observable discriminator between different star formation models is whether collapse occurs globally or locally. Recent ALMA and SMA observations have revealed global collapse in a few UC Hii regions which seem to favor the competitive accretion. We propose a systematic mini survey towards 45 clumps that show signatures of infall motions. The sample is drawn from a complete spectroscopy follow-up of the blind survey CSO/BGPS, thus is the least biased sample. Statistics of the infall properties of this sample will place distinguishable constraints on the star formation models. The study will also reveal a large, uniformly characterized sample with a high legacy value for ALMA follow-up.

Tiempo asignado: 44 horas

Propuesta: 2015B/008

Investigador Principal: Fabien Kouakou, Universidad de Chile

Título: Gas morphology and kinematics at the origin of the large-scale low-velocity shocks in the W43MM1 ridge

Resumen: Despite all the interest they present for the energetic budget of the Galaxy, the formation of high-mass stars remains poorly understood compared to their low-mass counterparts. High-mass stars are observed to form in cluster inside high density elongated structure (typical column density $> 10^{23} \text{ cm}^{-2}$), i.e. the ridges. The most massive ($\sim 2 \times 10^4 M_{\odot}$) and active ($\text{SFR} \sim 6000 M_{\odot} \text{ Myr}^{-1}$) of these ridges, lying at ~ 5.5 kpc from the sun in the W43-complex, is the witness of a strong and elongated SiO emission that cannot be associated to protostellar activity.

We are in the process of characterizing this SiO emission through the confrontation of 1D-shock models and multi-transition observations, demonstrating the act of low-velocity shocks. We now turn our attention to the next scientific question raised by this analysis: characterizing the gas at the origin of these shocks. To do so, we propose to use the APEX radiotelescope to trace the high density tracers with the $13\text{CS}(6-5)$ and $\text{N}_2\text{H}^+(3-2)$ line transitions typical of the 10^4 - 10^5 cm^{-3} volumetric cloud density of the W43MM1 ridge.

Tiempo asignado: 17 horas

Propuesta: 2015B/004

Investigador Principal: Leonardo Bronfman, Universidad de Chile

Título: The RCW120 HII region/IR bubble: characterizing the interaction between star formation and the ionized gas

Resumen: Star formation is observed at the edges of ionized (HII) regions. However, the causal link between the ionized front and the observed star formation is still unclear. We propose here to observe two zones at the edges of the Galactic HII region/IR bubble RCW120, where star formation is ongoing, and already observed within the SEDIGISM Survey in the J=2-1 transitions of ^{13}CO and C18O. This source is near (1.3 kpc) and has

been also studied in lower frequency tracers by MALT90, and in the continuum. We propose to use APEX-2 to map the J=3-2 transition of ^{12}CO and its isotopologues ^{13}CO and C ^{18}O to 1) study the dynamics of the highly excited gas at better resolution; 2) derive the physical conditions of the molecular gas; and 3) compare the interaction between molecular material and the photo-dissociation region for the two different zones, which show different star formation mechanisms

Tiempo asignado: 25 horas

Propuesta: 2015B/003

Investigador Principal: Michael Kuhn, Universidad de Valparaíso

Título: Mapping CO Clumps and Filaments in the RCW 38 Star-Forming Complex

Resumen: The little-studied RCW 38 star-forming region has produced the densest known OB cluster within 2 kpc, making it an ideal candidate for an in-depth study of star-cluster formation. We propose to map cloud clumps and filaments in ^{12}CO and ^{13}CO in the vicinity of the young cluster. The RCW 38 star-forming region is the subject of a study of cluster assembly, i.e., whether the star cluster was born through hierarchical mergers of subclusters or through the monolithic collapse of a single molecular clump, based on a deep, 200 ks Chandra X-ray Observatory integration (partially completed) to obtain a list of young stellar cluster members. The information provided by APEX mapping will allow us to 1) determine whether star-formation in the region is associated with molecular cloud filaments, 2) trace feedback effects such as gas removal and triggered star formation, and 3) evaluate star-formation rate and efficiency for individual molecular clumps.

Tiempo asignado: 15 horas

Propuesta: 2015B/005

Investigador Principal: Leonardo Bronfman, Universidad de Chile

Título: Properties of massive and dense Hi-GAL clumps in the outer Galaxy

Resumen: We propose to map 19 massive and dense clump-like sources identified by the Hi-GAL survey in the outer Galaxy (between $189 < l < 290$). Distances of sources were identified from crossmatch with CS(2-1) survey by Bronfman et al. (1996). Selected targets have surface densities above the values associated with high-mass star formation ($>1 \text{ g cm}^{-2}$), and have Galactocentric distances up to 13.6 kpc. Two different groups have distinctive properties that suggest different evolutionary stages. Prestellar candidates targets are cold ($T_{\text{d}} \sim 16 \text{ K}$), more extended (deconvolved angular size of 2300), and have lower $L_{\text{bol}} = M_{\text{env}}$ ratio (< 2) than the protostellar candidates (with 70 μm detections, $T_{\text{d}} \sim 23 \text{ K}$, size of 1300 and $L_{\text{bol}} = M_{\text{env}} \sim 37$). We plan to map these sources with CO(3-2) and $^{13}\text{CO}(3-2)$ to estimate the gas properties of these sources including virial masses and analyse them assuming local thermodynamic equilibrium, which will be compared to estimations from dust emission. Molecular abundances will be studied as a function of Galactocentric distances. For the 7 sources with higher CS(2-1) peak temperatures, we aim to obtain CS(7-6) emission, which will trace at better angular resolution the dense innermost regions of these clumps.

Tiempo asignado: 45 horas

Propuesta: 2015B/002

Investigador Principal: Monica Rubio, Universidad de Chile

Título: Molecular counterparts of methanol masers.

Resumen: For semester 2014-B we proposed to observe forty methanol masers from the Methanol Multibeam (MMB) survey, with the aim of identifying and characterizing their sub-millimeter molecular counterpart. Twenty of them were found to be associated with dust emission detected by ATLASGAL (Urquhart et al. 2013), while no dust counterpart was found towards the other twenty sources. Twelve sources were effectively observed during semester 2014-B. Here, we would like to observe the other twenty eight sources to complete the study. We propose to look for signs of star formation, in particular inflow/outflow evidences, towards the whole set of sources using molecular data obtained with APEX. To carry out this study we propose to perform observations of the $^{13}\text{CO}(2-1)$, $\text{C}^{18}\text{O}(2-1)$, and $\text{HCO}^+(3-2)$ lines towards the maser sources, which will provide information about the physical parameters of the associated molecular gas emission. This kind of study can help to discern if young stellar objects are also linked to methanol masers unassociated with cold dust emission.

Tiempo asignado: 9 horas

Propuesta: 2015B/009

Investigador Principal: Rolando Dünner, Pontificia Universidad Católica de Chile

Título: Dusty star-forming galaxy search from ACT source dataset

Resumen: The study of high-redshift dusty star-forming galaxies (DSFGs) is important to understand galaxy formation and evolution, as they can be the progenitors of the most massive local elliptical galaxies. We have blindly detected a list of 5 new DSFG candidates in the Atacama Cosmology Telescope (ACT) southern maps, which have been selected by measuring their fluxes in three frequency bands (150, 220 and 280 GHz) and disregarding sources with obvious local counterparts and with strong radio fluxes. This proposal is to measure those 5 sources using LABOCA to accurately determine their positions and fluxes at 870 μm with the aim to consolidate this sample and support further studies.

Tiempo asignado: 6 horas
