CONICYT
Ministerio de Educación
Gobierno de Chile

Comisión Nacional de Investigación Científica y Tecnológica – CONICYT

Resultados Concurso Apex 2014-B

Propuesta: 2014B/003

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 □2600 high-mass star-forming clumps within the Galaxy, obtaining small maps toward each clump in 15 molecular lines and one recombination line 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 highmass star-forming clumps, we now propose a large program, SuperMALT, to observe the higher J transitions toward a carefully selected sub-sample of the MALT90 clumps. Initial results show that the J=3-2/J=1-0 line ratios vary signicantly among the clumps, demonstrating a wide range of excitation conditions. The APEX data suggest that gas temperatures and densities increase with evolutionary stage, and hint at chemical variations. Having demonstrated successful APEX observations for our clumps, we now request additional time to sample more sources.

Tiempo asignado: 47 horas

Propuesta: 2014B/014

Investigador Principal: S. Kim, Pontificia Universidad Católica de Chile.

Título: [CII] line observation of star-forming lensed QSO and deep sub-mm imaging of its environment.

Resumen: Submillimeter observations allow us to access important interstellar medium (ISM) diagnostics and dust properties in the early Universe. Here, we propose to detect [CII] and the dust continuum emission in an exceptionally bright submillimeter galaxy (SMG) at z = 4.45. Our target (XMM18) is a lensed dusty starforming galaxy and could be a very interesting target for the sub-mm followup. Especially XMM18 is the only known X-ray detected lens at z > 4 in the samples within the two larget sub-mm surveys (H-ATLAS & HerMES) to date. A [CII] observation will enable us to study the abundance and ionization structure of this target and to constrain the radiation eld strength, gas density and temperature. We also expect to detect continuum from our target and its environment with higher sensitivity and angular resolution than a orded by Herschel SPIRE.

Tiempo asignado: 27 horas

Propuesta: 2014B/002

Investigador Principal: Leonardo Bronfman, Universidad de Chile

Título: Structure, Excitation, and Dynamics of the Inner Galactic Interstellar Medium (SEDIGISM).

Resumen: Over the last decade, many surveys performed systematic mapping of the inner Galactic Disk in the continuum at various wavelengths, e.g.: GLIMPSE (3.6-8 □m), MIPSGAL (24 and 70 □m), ATLASGAL (870 □m) and Hi-GAL (70-500 □m). Here we propose a systematic survey of the southern Galactic plane in the J=2{ 1 molecular transition of 13CO, similar to the Galactic Ring Survey (GRS) covering the northern Galactic plane in 13CO(1-0), but providing transformational new synergies with existing 13CO(1{0) data from the Three-mm Ultimate Mopra Milky Way Survey (ThrUMMS). We plan to map 78 deg2: -60□ l □ +18jbj□0.5, at 2800 resolution, to signicantly enhance ThrUMMS and fully complement GRS. We aim to: 1)constrain the large scale Galactic structure: spiral arms, and central bar; 2) produce a fully 3D realization of the molecular excitation and optical depth in the ISM; 3) achieve a complete census of lamentary structures, and probe their formation mechanism; 4) study the dynamics of the ISM at all scales (clumps, laments, and molecular complexes); and 5) measure the star formation process eciency as a function of environment.

Tiempo asignado: 20 horas

Propuesta: 2014B/010

Investigador Principal: Mónica Rubio, Universidad de Chile

Título: SuperCam survey of the LMC and SMC.

Resumen: We propose the first observations for the SuperCam Magellanic Cloud survey the first full-galaxy map of CO in the LMC and SMC with sub-arcmin resolution. Using the unique mapping capabilities of SuperCam, we will eventually cover 39 deg2 in the LMC and 5 deg2 in the SMC with 1800 resolution observations ofCO(3-2). These maps will enable a wide range of science, both on its own and in conjunction with existing observations of CO and dust emission from Spitzer and Herschel. We will study the evolution of GMCs, the star formation law, diffuse molecular gas, and more. In addition, the survey will provide the finding chart and zero-spacing component for a wide variety of ALMA Band 7 observations across this key target. In the first phase of this survey, we aim to observe 1/4 of the LMC (_10 deg2) split between this proposal and two companion, one led by Bergman et al. to map 30 Doradus and the molecular ridge in Swedish time and the other by Sandstrom et al. to map the LMC Bar in ESO time. In the SMC we will map 1 deg2 SWBAR area and in a companion proposal an additional 1deg2 in N83/N84 area led by Bolatto et al. in Swedish time. We request 51 hours of CHILE time to map the 2deg2 of the LMC and 1deg2 in the SMC.

Tiempo asignado: 51 horas

Propuesta: 2014B/001

Investigador Principal: Leonardo Bronfman, Universidad de Chile.

Título: Revealing the Transition from Atomic to Molecular ISM - A CI Survey of Planck Cores.

Resumen: Stars form in dense, largely molecular interstellar medium (ISM). The transition from HI to H2 is an essential step in forming molecular ISM. The transition from C+ to CO happens under similar conditions, and thus it is predicted to be a good tracer of the HI-H2 transition. In this project we propose to study the C+ to CO transition through observations of its associated CI enhancement, using FLASH receiver on APEX, for a sample of galactic cold cores which are selected from the Planck Early Cold Cores Catalog. Combined with an on-going study of HI-H2 transition with HI narrow self-absorption (HINSA) technique, this project will yield the first systematic dataset for studying the various (dynamical, chemical, thermal) factors concerning the transition from diffuse to dense ISM.

Tiempo asignado: 10 horas

Propuesta: 2014B/009

Investigador Principal: Leonardo Bronfman, Universidad de Chile.

Título: Complex organic molecules in the massive molecular outflow G331.512-0.103

Resumen: We propose to conduct a spectral line survey toward the massive and energetic molecular outflow G331.512-0.103. We aim to detect and to identify saturated complex organic molecules that have been probably formed as a result of the interaction of the strong outflow with its molecular environment. We would like to observe the source using the SHFi APEX-2 instrument with single point observations at several frequency setups. The excellent spectral resolution and sensitivity of APEX-2 will provide a perfect tool not only to detect and to identify rare and weak organic molecules, but also to characterize and determine important physical properties of the interstellar medium in the surroundings of the strong outflow by means of available LTE and non-LTE models. A positive detection of complex organic molecules with APEX will also give an extraordinary antecedent to further studies with high spatial resolution observations with the ALMA telescope.

Tiempo asignado: 10 horas

Propuesta: 2014B/006

Investigador Principal: Mónica Rubio, Universidad de Chile.

Título: Millimeter molecular counterparts of methanol masers.

Resumen: We would like to observe forty methanol masers from the Methanol Multibeam (MMB) survey, with the aim of identy_ng and characterizing their sub-millimeter molecular counterpart. Twenty of them have been 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. We propose to look for signs of star formation, in particular inow/outow evidences, towards the forty sources using molecular data obtained with APEX. To carry out this study we propose to perform observations of the 13CO(2-1), C18O(2-1), and 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: 10 horas

Propuesta: 2014B/016

Investigador Principal: Verónica Motta, Universidad de Valparaíso.

Título: Testing cosmologies with the Southern Massive Cluster Survey

Resumen: It is commonly accepted that the cosmological _CDM model provides the best description of the Universe. However, several puzzling results have questioned its validity. Galaxy clusters are invaluable for cosmological studies as independent and complementary observational probes to test the standard paradigm. We propose a comprehensive Sunyaev-Zel'dovich (SZ) survey of a complete and representative sample of the most X-ray luminous (hence most massive) galaxy clusters at $0.3 < z < 0.5$ observable only from the South. Our target list comprises galaxy clusters at $_ < -30^{\circ}$ from the Massive Cluster Survey (MACS) and its southern extension, SMACS. For each cluster target, we propose to measure the surface brightness profile of the SZ effect, along with the X-ray and spectroscopic data, to determine the clusters' SZ/X-ray distances. We will use them to test different alternatives to the _CDM paradigm, and constrain the relevant cosmological parameters (e.g._, k, h).

Tiempo asignado: 60 horas

Propuesta: 2014B/011

Investigador Principal: Hector Canovas, Universidad de Valparaíso.

Título: Probing the Photoevaporation scenario through the protoplanetary disk evolution.

Resumen: Protoplanetary disks evolve from being accreting, gas-rich disks (CTTS) to non-accreting, gas poor disks (WTTS). The intermediate stage of this evolution path is the so-called \transition-disk" (TDs) phase. These objects are characterized by the near infrared opacity holes observed in their inner disk zone, while their outer disks remain optically thick. Many di_erent mechanisms may play a relevant role in cleaning the inner part of the disks: grain growth, planet formation, binarity, and photoevaporation. The latter is generally thought to be the driving mechanism of the _nal disk clearing. However, the mass loss rates predicted by current photoevaporation models di_er by two orders of magnitude ranging from 10□8 to 10□10M_ yr□1, and observational input is urgently required to solve this issue. Photoevaporation models predict a direct relation between the strength of the X-ray luminosity and the outer disk mass. We propose to use the LABOCA/APEX bolometer to obtain 870_m continuum observations for a sample of 3 CTTS disks and 2 TDs with known X-ray luminosities and accretion rates. We will derive the disk masses with these observations, probing the photoevaporation scenario (X-ray luminosity VS. disk mass) at di_erent stages of the disk evolution.

Tiempo asignado: 8 horas

Propuesta: 2014B/007

Investigador Principal: Ricardo Finger, Universidad de Chile.

Título: Investigation of DNC/HNC and DCN/HCN ratios in massive star-forming regions with APEX.

Resumen: The relative abundance of deuterium in molecules provides a remarkable and almost unique diagnostic tool for studies of astrochemistry and astrophysics. According to the deuterium enrichment model, the deuterated fraction should drop after the protostellar birth, as is clearly observed in N2H+ in star-forming cores. However, previous observations show that the deuterated fraction of HNC show deviations from this general scenario. Since previous observations draw conclusion based on a small number of targets, additional data to investigate DNC/HNC evolution is highly desirable. we propose to observe DNC, DCN, HN13C, H13CN toward a sample of 65 giant molecular clumps to study the DNC/HNC and DCN/HCN evolution from high-mass starless cores to UCHII regions. The 4 GHz frequency bandwidth will cover many transitions, which will allow for investigating the relationship between deuterium fraction and physical and chemical properties of molecular clouds.

Tiempo asignado: 40 horas

Propuesta: 2014B/005

Investigador Principal: Jura Borissova, Universidad de Chile.

Título: Study of the Kinematical Correlation between UCHII reigons and PDRs

Resumen: High spectral resolution line observations toward ultracompact HII (UCHII) regions show ionized gas moving with respect to ambient molecular clouds at high speeds. It is not clear how these motions are initiated. One hypothesis is that the density gradients in the ambient molecular clouds cause pressure gradients, which constrain the expansion of the ionized gas and result in high speed bulk motions of the ionized gas. It is estimated that such constraints also affect the kinematics of the photodissociation region (PDR) gas. We propose to observe several UCHII regions and associated PDRs/molecular clouds in hydrogen radio recombination line and a few molecular lines to study kinematic structures in the ionized and molecular gases, and search for the evidence that the PDRs expand under the influence of the expansion of UCHII regions.

Tiempo asignado: 8 horas
