Comisión Nacional de Investigación Científica y Tecnológica - CONICYT

Resultados Concurso Apex 2012-A

Propuesta: 2012A-64

Investigador Principal: Roger Leiton**,** Universidad de Concepción

Título: Massive starbursts in high redshift cluster galaxies

Resumen: We propose 870μm imaging with LABOCA of the z 1.5 cluster J2215.9-1738, in order to probe highly obscured, massive starbursts in this high-density field. Previous work based on optical and 24μm observations suggest that J2215.9-1738 hosts, even in the cluster core, high levels of star formation activity. The availability of an extensive data set, also including MIPS (24μm), PACS (100, 160μm) and EVLA (20cm) observations, make this field an ideal target for this project. The combination of the proposed and available data will enable an accurate sampling on the far-IR SED of our targets, thus constraining infrared luminosities, dust temperatures, and SFRs.
The proposed sub-mm observations, together with data being acquired with multiple instruments on this field as well as on other distant cluster fields, will improve our understanding of massively star-forming galaxy populations in high-redshift clusters, at a cosmic epoch which is thought to be crucial for the formation of massive cluster galaxies.

Tiempo asignado: 30 Horas

Propuesta: 2012A-53

Investigador Principal: David R. Rodriguez, Universidad de Chile

Título: An Unbiased Line Spectral Survey of the V4046 Sgr Circumbinary Disk

Resumen: Disks orbiting pre main-sequence stars provide the basic material for planet formation. Evolved disks, such as those around V4046 Sgr and TWHya, are at evolutionary stages close to the giant planet formation step. Establishing the composition of residual gas within such disks is thus of prime importance for the understanding of the origin of elements in giant planets, comets, and Kuiper Belt objects. To date, our knowledge of the molecular content of even the best-characterized planet-forming disks is limited to perhaps a dozen or so species. This proposal aims to expand that knowledge and, hence, to reveal additional tracers of gaseous protoplanetary disks, by performing an unbiased line survey in the 265-357 GHz spectral range towards the evolved disk orbiting V4046 Sgr.

Tiempo asignado: 17.5 horas

Propuesta: 2012A-54

Investigador Principal: David R. Rodriguez, Universidad de Chile

Título: A Search for Molecular Gas in a Pair of Nearby T Tauri Systems

Resumen: Recent work has discovered hundreds of young stars (ages <100 Myr) in moving groups less than 100 pc from the Earth. Our own research with the GALEX satellite has revealed many previously unknown candidate young, low-mass stars. Two systems in particular have been con_rmed to be new members of the TW Hya Association. These possess very strong H_ emission, suggesting on-going accretion and the likelihood of molecular gas in the system. Such molecular disks orbiting pre-main sequence stars represent the raw materials necessary for (or leftover from) the formation of giant planets, Kuiper Belt objects, and comets. Evolved disks, such as those around V4046 Sgr and TW Hya, are at evolutionary stages close to this giant planet formation stage. The two systems we seek to investigate here have similar ages similar to those of V4046 Sgr and TW Hya (_8-10 Myr), are low mass (_ 0:15M_), and lie close the Earth (_100 pc), making them key systems to study the processes of planet formation among low mass stars. This proposal aims to detect the CO(3-2) rotational transition in order to test for the presence of a molecular disk around these two systems.

Tiempo asignado: 9 horas

Propuesta: 2012A-67

Investigador Principal: Mónica Rubio, Universidad de Chile

Título: Submillimeter cold gas and dust in the Magellanic Clouds: Dark gas in the SMC

Resumen: The Small Magellanic Cloud is a unique laboratory to study the gas, dust, and star formation in a low metallicity environment that resembles the early phases of galaxy formation. A key yet poorly explored aspect of the metal poor interstellar medium is its dust properties. Characterizing them is crucial to understand the gas heating, the interstellar medium thermodynamics, the dust-to-gas ratio, and to use dust continuum observations as a tracer of gas mass. Dust emission from low metallicity environments, particularly the SMC, appears to exhibit a submillimeter-wave excess that is likely associated with a change in the emissivity of dust grains. We propose to further explore the submillimeter properties of dust in the SMC by extending our successful LABOCA imaging program to the SMC-N and SMC-SWE region. These observations will be combined with Spitzer (SAGE) and Herschel (HERITAGE) data to determine the dust temperature and surface density distribution at the scale of giant molecular clouds and over a wide range of environments. A comparison with CO, Spitzer spectroscopy, and the planned [CI] and [CII] observations with Atacama telescopes and Herschel will allow us to determine the influence of environment on the dust properties, and yield a calibration for the submillimeter dust emissivity at low metallicities

Tiempo asignado: 42 horas

Propuesta: 2012A-61

Investigador Principal: H.M.L.G. Flohic, Universidad de Chile

Título: Filling the hole: sub-mm observations of LINERs for a more complete SED

Resumen: Highly sub-Eddington AGNs can be found at the heart of 50% of nearby galaxies, categorized as LINERs. At low accretion rate, the structure of the accretion ow changes dramatically and produces powerful outows in the form of wind and jets, which can a_ect the growth of the supermassive black hole by feedback. The
SEDs of the AGN in LINERs provide primary constraints for accretion ow models, but lack data in the sub-mm to far-IR range, where the primary synchrotron radiation from the hot electrons in the ow emerges. We propose to observe a subset of LINERs with LABOCA and SABOCA in order to measure the sub-mm uxes of their AGN, and test our models for accretion ows at low accretion rate. We selected targets likely to have no signi_cant contribution from the dust emission in the host galaxy, nor from large-scale radio jets.The new data points in the SED of these weak AGNs will allow us to better constrain our models of the accretion ow, and test their dependence on accretion rate.

Tiempo asignado: 4.4 horas

Propuesta: 2012A-58

Investigador Principal: D. Mardones**,** Universidad de Chile

Título: Outflow Temperature and Excitation Conditions of the Lowest Luminosity Protostar Known

Resumen: A detailed understanding of the temperature, excitation conditions, and driving mechanisms of molecular outflows driven by protostars, particularly the lowest luminosity protostars, is currently lacking. A molecular outflow driven by the very low luminosity protostar L673-7 (L _ 0.04 L⊙) was recently detected in CO 2-1 observations at the Caltech Submillimeter Observatory. We propose to map this outflow with APEX in the J=3-2, 4-3 transitions of CO, as well as in the isotopologue 13CO 3-2. We will derive the temperature of the outflowing gas by comparing the line ratios in different transitions to model predictions, as was recently done for higher luminosity sources. We will use the 13CO map to calculate and correct for the optical depth of the CO 3-2. With these results we will accurately determine the kinematic and dynamic properties of this outflow and study the underlying accretion history onto the protostar. More generally, our results will characterize the temperature and excitation conditions for an outflow driven by a very low luminosity object and allow us to investigate the outflow driving mechanism by comparing to model predictions for the variation of the outflow temperature along the outflow axis.

Tiempo asignado: 29 horas

Propuesta: 2012A-59

Investigador Principal: E. Servajean**,** Universidad de Chile

Título: The physical and kinematical conditions of massive starless clumps.

Resumen: A wealth of observations have shown that high-mass stars are formed within massive and dense clumps. However little is known about the way in which massive stars are formed within these clumps. Are they formed by accretion at the center of a single massive core or by competitive accretion of lower mass fragments? The Core Acrettion and Competitive Accretion models invoke very di erent initial conditions for the gas in the clumps that will eventually collapse to form a high-mass stars. Hence, to advance in our understanding of the way in which massive stars are born we propose here to undertake molecular line observations toward four cold massive and dense clumps that we discovered from a survey of dust continuum emission. These are ideal targets to investigate the initial conditions for high-mass star formation, not only because they are cold (T□15 K), implying that they are starless, but also because they are isolated. We plan to observe the emission in the N2H+ line, which will allow to determine the kinematics and physical properties of the densest regions within the clump, and in the HCO+ and HCN lines, which will will allow a detailed knowledge of the physical and kinematical properties of the larger scale, less dense surroundings.

Tiempo asignado: 28 horas

Propuesta: 2012A-66

Investigador Principal: Simon Casassus, Universidad de Chile

Título: Confirming the Circumstellar Nature of APEX/ASTE 12CO Detections around Dusty Young Stars

Resumen: The late pre-main sequence evolution of circumstellar gas and its influence on planet formation has not been characterised. Only a few gas-rich systems in the transition from protoplanetary to main sequence (MS) phases are known. With APEX and ASTE we have collected pointed CO(3-2) spectra toward 56 dusty young stars. We report a sample of 17 dusty disks with new CO detections. Unfortunately in some cases the contribution from diffuse CO is ambiguous. Only maps can give us a grip on the protoplanetary gas. Following up on our CO survey in protoplanetary disks, CO(3-2) maps will confirm the previous disk detections by sampling the ambient cloud contribution. Our objectives are 1) to characterize the evolution of the molecular gas and dust in protoplanetary disks through the ratio of infrared excess and integrated CO emission, 2) to identify new gas-rich systems and build up a southern sample of gaseous protoplanetary disks that can be targeted with ALMA, and 3) to extract statistics on the physical conditions inferred in the disks through radiative transfer models of the CO line profiles.

Tiempo asignado: 14 horas

Propuesta: 2012A-57

Investigador Principal: D. Mardones**,** Universidad de Chile

Título: Mapping Molecular Outflows to Study Protostellar Mass Accretion Histories

Resumen: A detailed study of the protostellar mass accretion process is crucial for a good understanding of star and planet formation; decoding the accretion histories stored in molecular outflows represents a unique means of developing this understanding. We propose to map nine known outflows in CO (2-1) to study the accretion histories of the driving sources over a wide range of evolutionary stages. By calculating the kinematic and dynamic properties of each outflow we will calculate the time-averaged protostellar mass accretion rates and expected accretion luminosities. We will compare these results to the current mass accretion rates, as indicated by the observed protostellar luminosities, in order to investigate whether mass accretion in the embedded phase is episodic rather than constant in time. We will combine the proposed maps with 10 others previously obtained from ASTE and other facilities in order to form a final sample of 19 maps of Class 0 and Class I protostellar outflows observed, reduced, and analyzed in a consistent manner. The 9 sources requested in this proposal are essential to fill in gaps in the evolutionary and luminosity coverage of our existing sample of 10 sources.

Tiempo asignado: 12 horas

Propuesta: 2012A-62

Investigador Principal: D. Mardones**,** Universidad de Chile

Título: Evidence of Triggered Star Formation on Bubble Edges: CO in the bubble rims

Resumen: Massive stars exert immense influence over their surrounding environment. The interaction of their winds and ionizing radiation with the dense material present in their natal environment can trigger subsequent generations of star formation. As the massive stars form HII regions, the surrounding material is swept up into higher density regions at the edge of the bubble, which then collapse to form stars. Churchwell et al. have cataloged hundreds of these bubbles from the GLIMPSE 8 μm images, and high column density features detected in the Bolocam Galactic Plane Survey (BGPS) of mm thermal dust continuum emission are often seen to coincide with the bubble edges. We propose to map 9 GLIMPSE bubbles and the associated
BGPS sources in CO(3-2) in order to assess the possibility of triggered star formation in the BGPS sources. Observations of CO(3-2) toward the bubble edges provide information on the kinematics of the lower-density gas within and surrounding the bubble edges, as well as outflows, which indicate on-going star formation. Comparison of the CO(3-2) with already obtained NH3, HCO+, and the BGPS data will allow us to determine whether the regions of dense gas surrounding the bubble are likely the result of triggered star formation.

Tiempo asignado: 28 horas

Propuesta: 2012A-48

Investigador Principal: Gisela A. Romero, Universidad de Valparaíso

Título: Millimetric and far IR observations of the ionized region Sh2-54

Resumen: Sh2-54 is an HII region characterized by a complex filamentary structure. The Spitzer-IRAC observations at 8.0 μm evidence the presence of several photo-dissociation regions (PDRs), indicating the existence of molecular gas surrounding the HII region. Because of the low resolution molecular images available today and the lack of surveyed far-IR data in this region, we would like to observe the cold dust emission at 0.8 mm using the LABOCA bolometer array, and the molecular emission in the 12CO(2-1), 13CO(2-1), and C18O(2-1) lines, with the APEX-1 SHFI instrument.
These observations would allow us to analyze and characterize the molecular gas and dust components related to Sh2-54, to identify dense molecular condensations possibly generated by the expansion of the HII region, and to test if triggered star formation is taking place in the environs of this region.

Tiempo asignado: 22.6 horas

Propuesta: 2012A-68

Investigador Principal: L. Bronfman, Universidad de Chile

Título: Physical characterization with SABOCA of ATLASGAL/BGPS massive star-forming clumps.

Resumen: Recent wide-area surveys at (sub) millimeter wavelengths have mapped the dust continuum emission in the Galactic plane. In these wavelengths the emission is considered optically thin and, therefore, a reliable tracer of column densities. The Bolocam Galactic Plane Survey (BGPS) mapped the Galaxy at 1.1 mm from l = -10 to 90 deg, while the ATLASGAL Survey mapped in 870 _m from l= -80 to +60. Here we propose to map with SABOCA, at 350 um, 14 massive star-forming clumps identi_ed in both BGPS and ATLASGAL in the overlapping region l= -10 to -6 deg. Inter-analysis of these data will allow determination of the temperature, mass, and density substructure for each source. Molecular line observations from the MALT90
Mopra survey will be used to derive kinematic distances. Eight additional sources from ATLASGAL, observed with MALT90, will be additionally mapped in search for correlation between the N2H+ to HCO+ ratio, a tracer of gas temperature, and the dust temperature derived from the continuum observations.

Tiempo asignado: 31 horas

Propuesta: 2012A-51

Investigador Principal: G.A. Romero, Universidad de Valparaíso

Título: Looking deeply inside the molecular fingerprints related to the star formation activity in G025.95+0.1255

Resumen: To take advantage on the well known fact that the environs of HII regions are excellent places to look for triggered massive-star formation, we would like to observe three BOLOCAM sources which are seen projected onto a molecular cloud associated with a diffuse HII region located at (l, b) = (25o.945, +0o.125). All the three BOLOCAM sources positionally coincide with 13CO molecular clumps. The goal of this project is to characterize the dense molecular clumps where star formation is taking place and to analyze the presence of molecular outflows. To perform this study we propose to focus on small areas centered at the position of each BOLOCAM source, in the molecular transitions 12CO(3-2), 13CO(3-2), HCO+(4-3), and CS(7-6). The analysis of these data would allow us to investigate the physical conditions where the YSO candidates are embedded and to better understand the mechanism involved in the formation of massive stars.

Tiempo asignado: 23.4 horas