Comisión Nacional de Investigación Científica y Tecnológica – CONICYT

Resultados Concurso Apex 2013-A

Propuesta: 2013A-06

Investigador Principal: Guido Garay, Universidad de Chile.

Título: Search for sub-millimeter water maser emission toward Water-Fountain Nebulae.

Resumen: The water maser emission at 22 GHz has proven to be an invaluable tool to study the kinematics of the gas in the circumstellar envelopes of evolved stars. A new class of objects dubbed "water fountain nebula" exhibit high velocity water masers that seem to be tracing a jet-like outflow. This type of outflows has been proposed to be the responsible for the formation of bipolar morphologies in planetary nebulae. In this project we propose to search for sub-mm water masers toward a sample of water fountain nebulae that exhibit strong 22 GHz maser emission. We expect to detect the emission at the very base of the jets, which will allow us to understand the mechanisms responsible for the launching of this collimated outflows. If we succeed at detecting the sub-mm water masers, it will be the first time that this emission is found in this type of objects. Additionally, the results will be the prelude for future interferometric observations with ALMA.

Tiempo asignado: 9.25 horas

Propuesta: 2013A-17

Investigador Principal: Jorge Gonzalez, Pontificia Universidad Católica de Chile.

Título: Deep Sub-millimeter imaging of CLASH galaxy clusters.

Resumen: The Cluster Lensing and Supernova survey with Hubble (CLASH) is a 524-orbit multi-wavelength HST program to use gravitational lensing by 25 galaxy clusters to constrain models of galaxy and structure formation with unprecedented accuracy. Despite the unique panchromatic nature of this survey, CLASH lacks a key measurement at submillimeter wavelengths to locate lensed background submillimeter galaxies (SMGs). We propose to perform deep 870_m imaging of 8 of the 25 CLASH clusters using LABOCA on the APEX telescope. These observations will be crucial to identify the strongly magnified, high-redshift SMGs in the background of these clusters. Taking advantage of radio positions and the superb multi-band high-resolution optical/near-IR imaging with HST we will be able to fully characterize the global properties of many intrinsically faint SMGs (SFR, stellar mass, redshift) and study their morphologies by reconstructing the source plane with unprecedented detail in turn.

Tiempo asignado: 48 horas

Propuesta: 2013A-15

Investigador Principal: Demerese Salter, Pontificia Universidad Católica de Chile.

Título: A line survey to detect evidence of photoprocessing in the protoplanetary disks around Herbig Ae/Be stars

Resumen: Pre-main-sequence stars are often surrounded by gas and dust disks, the likely birthsites of planets. As the dust particles in these disks grow and settle to the disk midplane, they leave the molecular gas more exposed to the photoionizing X-ray and photodissociating ultraviolet radiation from the central forming star.
Theoretical models predict that the abundances of certain molecular species will become enhanced at the expense of others in stronger radiation fields. We propose to observe 10 disks in lines of 13CO, CN, HCN, and HCO+ with the APEX-1 (SHeFI) receiver in order to measure the abundances of these molecules shown to trace photoprocessing effects. Our objects were selected from a sample of disks around Herbig Ae/Be stars that have very well-characterized dust properties and span a range in grain growth and dust settling stages, as derived from Spitzer IRS spectra and radiative transfer models fit to the full infrared-to-millimeter spectral energy distributions. Each object has already been detected in lines of 12CO, suggesting that a sufficient reservoir of cold gas is present in each disk. The proposed observations will help us to identify gas-rich southern disks in the early stages of planet formation that will be suitable for follow-up with ALMA.

Tiempo asignado: 15 horas

Propuesta: 2013A-13

Investigador Principal: Diego Mardones, Universidad de Chile

Título: Physical Conditions in Massive Molecular Outflows

Resumen: We propose to observe 5 massive outflow sources in high-J CO transitions using CHAMPP. All have detected sub-arcminute CO 3-2 bipolar high velocity emission, and three of them have detected luminous cm-continuum jets with ATCA. Observations with CHAMP+ will permit us to probe the high velocity outflow with higher angular resolution, allowing us to resolve the spatial structure of the outflow and assess whether or not the ionized jet is the energy source of the molecular outflows. These observations will allow us precise determination of outflow gas temperatures. This is essential for accurate determination of outflow mass, momentum, and energy per unit velocity, essential to discriminate between accretion and coalescence star formation models for the highest mass protostars.

Tiempo asignado: 9 horas

Propuesta: 2013A-01

Investigador Principal: Leonardo Bronfman, Universidad de Chile

Título: Probing the SgrA* accretion stream and source variability during the passage of DSO/G2

Resumen: A dusty S-cluster object (DSO/G2) approaches SgrA* and will be in periapse in mid-September 2013. The expected NIR and X-ray ux density of SgrA* will increase substantially. The enhanced activity will be strong in the sub-mm part as well, and is expected to follow the NIR events. To probe the accretion process and investigate geometrical aspects of the enhanced activity we propose additional APEX observations aroound June 2013 that should be in parallel with the proposed ESO Ks/L'-band polarization observations. The June run is essential for comparison to the data we hope to obtain for September 2013 and March 2014 in parallel with XMM observations. Strong activity will also give an outstanding opportunity to improve the derivation of the spin and inclination of the SMBH from NIR/sub-mm observations. Main goal here is a rigorous statistical analysis of the concatenated sub-mm light curve covering 9 years (in conjunction with the NIR and X-ray data).

Tiempo asignado: 14 horas

Propuesta: 2013A-14

Investigador Principal: Laura Gomez, Universidad de Chile

Título: Fragmentation Study and Spectral Energy Distributions of Infrared Dark Clouds

Resumen: The so-called Infrared Dark Clouds (IRDCs) are defined as regions of high extinction viewed against the bright, diffuse MIR Galactic background. It is believed that some clumps within IRDCs have the potential of harboring the earliest stages of massive star formation. Here, we propose to observe with SABOCA five of the high extinction IRDCs (in 24 μm images). These clouds were observed with the LABOCA on APEX and resulted in high sensitivity 870 μm continuum images that show strong dust continuum emission and spectacular filamentary morphologies. The SABOCA observations will be crucial to constrain the temperature and dust properties in the Spectral Energy Distributions of these clouds. Given the high angular resolution of SABOCA, we will be able to analyse in detail the morphology of filaments and embedded high-density clumps. We will also have the unique opportunity to study the dust in both absorption and emission.

Tiempo asignado: 8.3 horas

Propuesta: 2013A-03

Investigador Principal: Leonardo Vanzi, Pontificia Universidad Católica de Chile.

Título: Dust temperatures in K+A galaxies

Resumen: We propose a pilot survey of K+A galaxies with LABOCA to constrain their dust properties. Our analysis of the (GALEX; SDSS; 2MASS; WISE) SEDs of 808 K+A galaxies over two decades in wavelength revealed that nearly all galaxies possess a significant excess at _ > 5 μm, which cannot be fitted by dust at a single temperature. K+A galaxies have weak emission lines from which they are classified as either 'Retired Galaxies' (RG; ionization by old, hot stars), and 'Weak AGN' (wAGN: ionized by a highly obscured AGN or starburst). wAGN K+A's tend to have stronger hot dust components, but data beyond 22μ are required to constrain the dust temperatures. If one of the dust components is at Tdust ⇠ 50oK, then K+A galaxies will have flux densities of up to several hundred mJy at 870μ, but they will be undetected if the dust is hotter than ⇠100K. By observing a sample of 20 of our K+A galaxies we will be able to correlate the properties of the dust with the stellar populations and the colors of the SED. Fits to the SEDs from the FUV (0.15μ) to 870μ will allow us to constrain much better the temperature of the hotter dust component, and thus to probe whether the dust is heated by an AGN or by a Starburst in these galaxies.

Tiempo asignado: 10 horas

Propuesta: 2013A-16

Investigador Principal: Adele Plunkett, Universidad de Chile

Título: The impacts of protostellar outflows on their cluster environments

Resumen: Outflows are vital feedback components to the star formation process, injecting momentum and energy into the cloud, and likely feeding turbulent motion. Although the role of outflows is relatively well understood for isolated, low-mass stars, the impact of outflows on surrounding clustered environments, where most intermediate- to high-mass stars form, remains unknown. A consistent survey of star forming regions with a range of masses and ages will allow us to study the interaction of outflows and their surrounding clouds, with the goal of determining trends in protocluster evolution. We propose APEX observations of the region M8 as an important part of this study, which already comprises multi-wavelength observations of the complementary regions Serpens South and Circinus. We will map CO (3-2) to trace warm outflow emission in a 6x10 arcmin region where the protostellar fraction is highest. We will determine outflow properties (i.e. mass, momentum and energy), and compare with overall cloud properties in this region, which is the most massive and oldest in our sample. By building a consistent sample of observations, we will study how the impact of outflows changes with relative evolutionary stage of star formation in clusters.

Tiempo asignado: 15 horas

Propuesta: 2013A-10

Investigador Principal: Pía Amigo, Pontificia Universidad Católica de Chile

Título: The G347.6+0.2 star forming region: Revealing starburst episodes beyond the Galactic Center.

Resumen: We propose to map at 870μm and 350μm with LABOCA and SABOCA the star forming region G347.6+0.2. This region is particularly interesting since it is located at a distance of 8–9 kpc and may be located in the very center of the Galaxy or beyond the Galactic center. This represents an excellent opportunity to observe star formation at the Galactic center. The star formation in the region may be triggered by the nearby young massive stellar cluster DBS2003 179, recently studied by our group with VVV images. The main goal of our project is to characterize star formation within this complex, and the proposed APEX observations will help to trace the distribution of cold dust and the progenitors of high mass stars, leading to a better understanding of star formation in this Galactic region.

Tiempo asignado: 24 horas

Propuesta: 2013A-12

Investigador Principal: Gerrit van der Plas, Universidad de Chile

Título: Molecular gas in disks around nearby young brown dwarves

Resumen: Young Brown Dwarves (BDs) with infrared excess are an exciting new environment to test the limits of planetary formation in protoplanetary disks. The molecular gas content of disks around BDs is still an unknown. Gas plays a large part in disk evolution, and the dispersion of the gas from the disk sets _rm upper limits on giant planet formation. We propose to search for 12CO J=3-2 emission at 345.86 GHz in the disks around two nearby BDs (Spectral types M6 and M8.5) in the TW Hydrae Association. This will allow us to set limits on the molecular gas content of the disks. With these observations we will reach a 3 _ detection limit of 0.1M_ on the amount of dust in the disk, and thus place stringent constraints on the planet forming potential of these disks. These observations will establish prime targets for gas rich disks around sub-stellar mass objects that can be observed with large radio telescopes such as ALMA, and are complementary to our Cycle 1 ALMA proposal to detect and characterize BD disks in two other nearby star forming regions.

Tiempo asignado: 16 horas

Propuesta: 2013A-09

Investigador Principal: Jura Borissova, Universidad de Valparaíso

Título: Continuum and spectral map of the dust shell around WR star in the young stellar cluster VVV CL036.

Resumen: Wolf-Rayet stars have smaller mass-loss rates than their progenitors, i.e. Red Super Giant or Luminous Blue Variable stars, but have winds with higher velocities, up to 3–4000 km s−1. As the fast WR wind expands, it creates a dense shell of swept up material, the WR nebula, that expands outward and interacts with the material ejected during its previous evolutionary phase. The detailed shape of the shell gives information on the progenitor of the WR star. In order to study the nature of the newly discovered WR nebula in the cluster VVV CL036, we propose to map the region at 350μm with SABOCA and APEX-1 heterodyne receivers on APEX telescope, to obtain information both for the continuum and molecular emission in this source, namely CO, HCO, HCN, etc. Together these observations will allow investigation of the dust and gas. In particular, we will measure the dust temperature, uncover a range of molecular lines, and obtain the gas kinematics using the brightest line emission. We want to verify if the bright spot G312.13+00.20 is a YSO, possibly triggered by the ejection. Moreover, these observations will be stepping stones to plan and obtain ALMA observations in both line and continuum to eventually dissect the source at high spatial resolution.

Tiempo asignado: 14 horas

Propuesta: 2013A-18

Investigador Principal: Claudio Caceres, Universidad de Valparaíso

Título: The masses of transition disks: testing the photoevaporation scenario.

Resumen: Transition disks are young stellar objects that present opacity holes in their inner disk zone, while their outer disks appear to be optically thick. These objects are thought to be the intermediate stage between the primordial gas-rich disks that show strong signs of accretion and more evolved disks with neither signs of accretion nor evidence of gas. The origin of the opacity hole is not fully understood, as many different 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 final disk clearing. However, the mass loss rates predicted by current photoevaporation models differ by two orders of magnitue ranging from 10−8 to 10−10M_ yr−1 and observational input is urgently required to solve this issue. As photoevaporation models predict a relation between the strength of the X-ray luminosity and the outer disk mass of transition disks. Here, we therefore propose to use the APEX/LABOCA bolometer to obtain 870 μm continuum observations for a selected sample of 10 transition disks with different accretion rates and X-ray luminosities.

Tiempo asignado: 9.3 horas

Propuesta: 2013A-11

Investigador Principal: Sergio Torres, Universidad de La Serena

Título: Studying the Schmidt-Kennicutt law for merging/interacting galaxies

Resumen: The Schmidt-Kennicutt law relates the star formation rate and gas density in spiral galaxies, _SFR and _H2, respectively. Recently, some authors have found that starburst and spiral galaxies follow different laws in the _SFR versus _H2 plane, suggesting the existence of two different star formation regimes. In this sense, it results crucial the study of the Schmidt-Kennicutt law for local and well resolved merging/interacting galaxies, where we can identify strong star-forming regions in the merging objects. In this proposal we ask for APEX observing time to study, the _SFR versus _H2 law for a interacting galaxy in sub-kpc scales. We propose to use the APEX-1 (SHeFI) instrument to map the CO(2–1) emission in the system NGC 1313 and determine its H2 mass content and _H2. By using GALEX and Spitzer archival data of NGC 1313, we will estimate the _SFR for different small-scale regions in this system. The analysis of the _SFR versus _H2 plane for NGC 1313 will allow us, a detailed study of the different star formation regimes in an interacting galaxy. This analysis will be complemented with the APEX data of the system NGC 1487, which displays two extended tidal tails, different to the morphology observed in NGC 1313.

Tiempo asignado: 14.4 horas

Propuesta: 2013A-07

Investigador Principal: Hector Canovas, Universidad de Valparaíso

Título: Massive star formation around G025.95+0.125

Resumen: Given 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 di_use HII region located at (l, b) = (25o.945, +0o.125). The three BOLOCAM sources positionally coincide with 13CO molecular clumps. The goal of this project is to characterize the dense clumps where star formation is taking place and to analyze the presence of molecular outows. To perform this study we propose to map a region of 90 x 90 arcsec 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

Propuesta: 2013A-02

Investigador Principal: Michel Cure, Universidad de Valparaíso

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

Resumen: Sh2-54 is an expanding HII region characterized by a complex filamentary structure. Based on the optical image, which shows a high extinction region bordering the HII region, the presence of several photo-dissociation regions (PDRs) indicating the existence of molecular gas surrounding the HII region, and a number of candidate YSOs projected onto Sh2-54 and its surrounding, it is possible to propose that Sh2-54 is triggering the stellar formation. Due to the low resolution of the molecular data available today and the lack of surveyed far-IR data in this region, a detail analysis is not posible. For this reason, we would like to observe the cold dust emission at 870 μm using the LABOCA bolometer array, and the molecular emission in the DCO+(3-2), SiO(5-4), H2CO(3-2), 12CO(2-1), 13CO(2-1), and C18O(2-1) lines, with the SHeFI APEX-1 instrument. These observations would allow us to analyze and characterize the cold dense molecular clouds and dust related to the early-stages of the stellar formation, to identify the presence of molecular outflows linked to YSOs, and to characterize the PDR around Sh2-54.

Tiempo asignado: 20.3 horas

Propuesta: 2013A-04

Investigador Principal: Leonardo Bronfman, Universidad de Chile

Título: The center of NGC 6357: multiple star formation scenarios in action.

Resumen: NGC 6357 consists of a large ionized shell and a number of smaller optical nebulosities. The optical, radio continuum, and near- and mid-IR images delineate the distributions of the ionized gas and interstellar dust in the HII regions linked to the massive stars in Pis 24 revealing that they are surrounded by photodissociation regions. NANTEN data at 115 GHz of the CO(1-0) line allowed us to identify the molecular counterparts of the ionized structures in the complex and to confirm the edges of photodissociation regions. We would like to observe the more abundant CO isotopes in the J=2-1 line aiming to identify molecular clumps possibly related to candidate YSOs. In addition, the observation of the H2CO(3-2) line will help us to detect cold dense regions associated to infrared dark clouds, starless cores or pre-stellar cores. We also propose to observe the SiO(5-4) line to help us to detect molecular outflows.

Tiempo asignado: 15 horas

Propuesta: 2013A-09 A

Investigador Principal: Jura Borissova, Universidad de Valparaíso

Título: Continuum and spectral map of the dust shell around WR star in the young stellar cluster VVV CL036.

Resumen: Wolf-Rayet stars have smaller mass-loss rates than their progenitors, i.e. Red Super Giant or Luminous Blue
Variable stars, but have winds with higher velocities, up to 3–4000 km s−1. As the fast WR wind expands, it creates a dense shell of swept up material, the WR nebula, that expands outward and interacts with the material ejected during its previous evolutionary phase. The detailed shape of the shell gives information on the progenitor of the WR star. In order to study the nature of the newly discovered WR nebula in the cluster VVV CL036, we propose to map the region at 350μm with SABOCA and APEX-1 heterodyne receivers on APEX telescope, to obtain information both for the continuum and molecular emission in this source, namely CO, HCO, HCN, etc. Together these observations will allow investigation of the dust and gas. In particular, we will measure the dust temperature, uncover a range of molecular lines, and obtain the gas kinematics using the brightest line emission. We want to verify if the bright spot G312.13+00.20 is a YSO, possibly triggered by the ejection. Moreover, these observations will be stepping stones to plan and obtain ALMA observations in both line and continuum to eventually dissect the source at high spatial resolution.

Tiempo asignado: 9.6 horas

Propuesta: 2013A-05

Investigador Principal: Alexandre Roman, Universidad de La Serena

Título: SHFI APEX CO (2-1) observations of the RCW106 massive star forming complex

Resumen: In this work we want to perform CO(2-1) OTF maps in the direction of several star forming sites of the massive galactic star formation complex RCW106. The primary goal is to derive physical properties of the molecular gas like (in a _rst moment from the CO(2-1) alone), the spatial distribution and mass of molecular gas for each detected condensation, the MFWHM of the lines, the kinematic properties in the inermost regions, the velocity _elds, etc. With these data in hands, we will study their relationship with the associated stellar population detected from new deep near-infrared (NIR) imaging data obtained from the VISTA Variables in the Via-Lactea (VVV) survey. Later, a follow up study will target some very speci_c regions with observations of the CO(3-2) transition and CO isotopomers and other molecular species, to reveal further information about the state of the gas. The excellent spatial resolution and sensitivity of the SHFI APEX instrumental con_guration, make it well suitable to provide us the tools needed to achieve the goals of this project.

Tiempo asignado: 33.7 horas
