



Comisión Nacional de Investigación
Científica y Tecnológica - CONICYT

Resultados Concurso Apex 2011-B

Propuesta: 2011B-72

Investigador Principal: Leopoldo Infante

Universidad: Pontificia U. Católica de Chile

Título: LASCAR: the LABOCA/ACT Survey of Clusters at All Redshifts.

Resumen: We propose to complete our ESO/MPG/OSO/Chile survey to obtain LABOCA 870 μm maps of 15 of the most massive galaxy clusters in a 455 square degree southern strip surveyed by the Atacama Cosmology Telescope (ACT). Our targets were identified by their 148 GHz Sunyaev-Zel'dovich Effect (SZE) decrements, which provide a redshift-independent mass selection, and confirmed with optical imaging. The LABOCA maps will exploit the clusters' gravitational lensing for the detection of background submillimeter galaxies over a range in cluster-centric radius, thereby furnishing good candidates for followup with ALMA and placing valuable constraints on how severely individual galaxies may undermine the cosmological conclusions of ACT and other SZE surveys. Digging deeper, we will also use our maps to measure the clusters' SZE increments, and the 870 μm flux densities of sources (or stacks of sources) selected at other wavelengths. In this last Chilean proposal, we ask to map one cluster through Chilean APEX Observing time in semester 2011B.

Tiempo asignado: 25 horas

Propuesta: 2011B-71

Investigador Principal: Simon Casassus

Universidad: Universidad de Chile

Título: Search for CI in protoplanetary disks.

Resumen: Models of the structure and chemistry of protoplanetary disks indicate they have a layered structure, with ionised gas at the surface, an atomic neutral layer and deeper down, mostly molecular gas. The molecular gas is most easily detected with CO, and is well-studied in many disks. However, the physical and chemical state of the upper disk layers have not been observed. Our recent Herschel observations show that ionised carbon from the outer layer (the ν_2 structure line at 157 μm) is surprisingly not detected - even in the brighter disks. We are evaluating what this means for the models. We propose deep searches for the neutral atomic carbon content using APEX, to further determine the location of C in the surface layers. CI is most easily detected through the 3P1 \rightarrow 3P0 line at 492GHz - accessible only in good atmospheric conditions. Our preliminary JCMT observation of TW Hya are much less sensitive than could be done with APEX3, with which we hope to obtain the first C I detection in a disk, or else place new constraints on model disks. We will also observe another 2 of the brightest isolated protoplanetary disks which may also show this line. These observations would place us in the front-line for ALMA C I observations, possible only starting cycle-1.

Tiempo asignado: 12 horas

Propuesta: 2011B-50

Investigador Principal: Gustavo Orellana

Universidad: Universidad de Concepción

Título: ZSPARC: the Z-Spec/APEX Redshift Campaign for H-ATLAS: The Chilean Sub-Sample

Resumen: It is no surprise that the largest extragalactic *Herschel* survey, H-ATLAS, has provided by far the brightest sample of lensed FIR galaxies. Sub-100-deg² surveys miss the rarest high-amplification systems. As demonstrated by our success rate with Z-Spec observations in January, our Z-spec sample allows us to study the galaxies that dominate the FIR background and the star-formation-rate density at the peak epoch of starburst/AGN activity. By June, *Herschel* will have covered the largest H-ATLAS field (SGP, 260 deg², 22 < α < 02h; δ \approx 30°). We can thus select even brighter SMGs, obtaining redshifts, determining their gas properties via the CO ladder and exploring the influence of AGN, whilst relatively immune to uncertainties in the lensing models. With Z-Spec redshifts in hand, we will have the ultimate sample to exploit ALMA, mapping their sub-kpc internal structures, in powerful diagnostic transitions such as [C ii], 13CO and C18O, on the scale of individual GMCs. The sub-project proposed here, led by Chileans, and to be published as Orellana et al. is complementary to an ESO application by the H-ATLAS team. The program proposed here will lead to a long term collaboration between UdeC and the H-ATLAS team.

Tiempo asignado: 24 horas

Propuesta: 2011B-69

Investigador Principal: Diego Mardones

Universidad: Universidad de Chile

Título: Evidence of Triggered Star Formation on Bubble Edges

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 μ m 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 HCO+(3-2) in order to assess the possibility of triggered star formation in the BGPS sources. Kinematic information is necessary to ensure that the BGPS sources are coherent structures that are consistent with the collect and collapse scenario of triggered star formation. The HCO+ line profiles will also provide insight into the dynamical state of the dense gas including signatures of infall and outflow, which will provide evidence of on-going star formation.

Tiempo asignado: 28 horas

Propuesta: 2011B-63

Investigador Principal: C. Vlahakis

Universidad: Universidad de Chile

Título: The molecular content of Hi-rich early-type galaxies.

Resumen: Until recently, early-type galaxies (ETGs) had long been considered to be gas-poor systems. Yet, recent studies suggest that they contain a significant amount of cold gas, whose origin is still a subject of much current debate. We propose to observe seven optically selected Hi-rich ETGs in low density environments in the CO J=2-1 transition using the SHFI APEX-1 receiver at APEX, in order to study their molecular gas content. These ETGs have recently been studied at 21-cm with the ALFALFA survey, and a large fraction have significant quantities of neutral hydrogen and show traces of recent star formation activity. Combining these new CO observations with existing Hi and optical data will allow us to investigate the important relation between molecular gas, neutral gas and star formation. This is crucial for understanding the nature of ETGs, providing important clues about their formation and evolutionary scenarios. For this we request a total of 17.5 hours observing time to study the CO J=2-1 emission in seven ETGs.

Tiempo asignado: 17.5 horas

Propuesta: 2011B-67

Investigador Principal: Yanett Contreras

Universidad: Universidad de Chile

Título: Study of filamentary structure across the Galactic Plane.

Resumen: Observations made during the last few years, shown that molecular clouds contain a large number of filamentary structures. The physical and kinematical properties of these structures is still poorly understood. The study of physical properties of these filamentary structures will help us to get a better understanding of the physical processes involved in the formation of massive stars. We propose to undertake dust continuum observations at 350 μm that together with the 850 μm data will allow us to obtain temperatures and spectral indexes of these filamentary structures. We also propose molecular line observations which will allow us to determine the velocity field of the whole filamentary structures and to assess whether they corresponds to single large physical structures or different sub-structures along the line of sight. The regions we propose to observe completes the regions observed in previous proposals and will allow to perform a systematic and homogeneous study of molecular clouds that possess filamentary structures.

Tiempo asignado: 1.6 – 8 horas

Propuesta: 2011B-68

Investigador Principal: Matthias Schreiber

Universidad: Universidad de Valparaíso

Título: Detecting molecular gas in transition disk

Resumen: Transition objects are pre-main-sequence stars with optically thin inner disks and optically thick outer disks. We recently performed a large scale multi-wavelength survey of Spitzer selected transition disks that allows to distinguish between different mechanisms that can produce the inner opacity holes. These results are entirely based on emission from the dust component but make crucial predictions for the gas content of the disk. Planet forming disks should contain enough gas to form giant planets, photoevaporating disks should have gas rich outer disks but debris disks should be gas poor and should not be detected in CO. We here propose to complement our previous results by observing the gas component of three selected transition disk systems, a planet forming disk candidate, a photoevaporating disk candidate and a debris disk candidate.

Tiempo asignado: 12.6 horas

Propuesta: 2011B-60

Investigador Principal: Nadia Lo

Universidad: Universidad de Chile

Título: Probing the possibility of triggered star formation.

Resumen: Whether star formation are triggered is one of the major topics in star formation, to investigate the possibility of triggered star formation we propose molecular line observations of RCW 36 with SHFI 230 and SHFI 345. RCW 36 consists of a deeply embedded star cluster, ultra compact Hii region and cold dust clumps, star formation in different stages coexist in a small region. We are developing models to simulate the molecular emissions in RCW 36, however to get better constraints on the physical environments (e.g. mass, temperature), high J transitions of molecular line is required.

Tiempo asignado: 2.6 – 4.2 horas

Propuesta: 2011B-70

Investigador Principal: Gisela A. Romero

Universidad: Universidad de Valparaíso

Título: Molecular mapping of southern dust cavities

Resumen: We would like to map a southern star-forming region of 12' in size including S21 to S24 of the list by Churchwell et al. (2006), where massive stars have blown multiple shells and bubbles of varying sizes in the surrounding molecular material. The observations will include 13CO(2-1) and 12CO(2-1) lines of the whole region and 13CO(3-2) and 12CO(3-2) lines of a smaller region around S24. We would use the molecular data to 1) determine kinematic distances to the regions, 2) measure the associated molecular mass, 3) search for signatures of expansion, 4) measure excitation temperatures as a function of radius, and 5) compare the molecular conditions of the regions where young stars are forming with more quiescent clouds. These data would comprise a key piece of a multi-wavelength dataset investigating the evolution of interstellar bubbles and the impacts of stellar feedback. The region S24 was partially observed in the 13CO(3-2) line during 2010B. In the present proposal we apply for observing time to complete the project.

Tiempo asignado: 20 horas

Propuesta: 2011B-66A

Investigador Principal: Michel Curé

Universidad: Universidad de Valparaíso

Título: Inspecting dust formation activity in the surroundings of WR 65 and WR 112

Resumen: The Wolf-Rayet stars WR112 & WR65 show excess IR fluxes thought to originate in hot dust formed in carbon-rich WR+OB massive binary system. The dense stellar winds collide in a bow-shock region defined by an equilibrium between the ram-pressures of the two winds. The high density of matter in this region allows dust to form, although details of the actual process are lacking. With the aim of providing unique constraints both on the amount of the circumstellar dust and on the dust formation mechanism in the binary systems, we propose to use the APEX telescope to observe the continuum dust emission at 870 & 350 μm , and the vibrationally excited CO emission $v = 1$, $J = 3 - 2$ and $J = 2 - 1$ at 342.6 and 228.4GHz. We request observing time of 4.7h with LABOCA and 12.1h with SABOCA to reach rms of 2, 4 mJy/beam, and 9 mJy/beam to have a 5 σ detection, and 5.0h with SHFI to observe the lines at 1 km s $^{-1}$ resolution with rms down to 0.01 K.

Tiempo asignado: 10 horas

Propuesta: 2011B-73A

Investigador Principal: Rodolfo Barba

Universidad: Universidad de La Serena

Título: Millimetric observations of the galactic nebula NGC 3503

Resumen: NGC 3503 is a optical emission nebula ionized by early B-type stars belonging to the open cluster Pismis 17 (from here onwards, Pis 17). NANTEN 12CO observations evidenced the presence of a molecular cloud at a velocity of ~ -25 km s⁻¹ associated with the nebula. The stars of Pis 17 seems to have disrupted the molecular gas and formed a photo-dissociation region (PDR) at the interface between the molecular and ionized gas, and a champagne flow in the opposite direction. Given the low resolution of the NANTEN data, we would like to observe the molecular emission in both, 12CO (2-1) and 13CO (2-1) lines, as well as high density molecular lines (CS (5-4) and HCN (3-2)) with the APEX-1 SHFI instrument. These observations would allow us to analyse and characterize the molecular gas related to NGC 3503. Physical parameters, such as excitation temperatures, opacity, densities, and masses could be derived accurately. These observations would also allow performing a study of the molecular gas associated with the PDR at the interface between NGC 3503 and its molecular gas, and providing some information about star formation in the region.

Tiempo asignado: 6 horas.

Propuesta: 2011B-52

Investigador Principal: Diego Mardones

Universidad: Universidad de Chile

Título: Temperature and Excitation Conditions of an Outflow Driven by a Very Low Luminosity Protostar

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 ($L \sim 0.04 L_{\odot}$) was recently detected in CO 2-1 observations at the Caltech Submillimeter Observatory. We propose to map this outflow with APEX in multiple J transitions of CO, including 3-2, 4-3, 6-5, and 7-6, as well as in the isotopologues 13CO 3-2 and 4-3. 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 also use the 13CO maps to calculate and correct for the optical depth of the CO 3-2 and 4-3 maps. 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: 4.2 – 23.6 horas

Propuesta: 2011B-62A

Investigador Principal: Mónica Rubio

Universidad: Universidad de Chile

Título: Dust, Molecules, and Star Formation at Low Metallicity.

Resumen: Dust affects the cooling cycle in the ISM and this affects the ability of a galaxy to form cold, dense clouds that can form stars. Thus, the low dust content of dwarf irregular galaxies should have consequences to the star formation process, but just what is the connection? We obtained a LABOCA 870 μm map of part of the low metallicity dwarf WLM and propose here to use LABOCA to map three more dwarf galaxies. These data will trace the cold FIR dust continuum emission of low metallicity systems, and reveal probable sites of molecular material. These data, in combination with our exquisite HI maps and star formation history maps, will allow us to examine the relationship between the dust content, gas, and star formation in a metal-poor dwarf galaxy. This will be important for understanding the evolution of dwarfs and star formation in the early universe.

Tiempo asignado: 10 horas

Propuesta: 2011B-56

Investigador Principal: Gisela Romero

Universidad: Universidad de Valparaíso,

Título: Submillimeter and far-IR observations of young stellar objects in the edge of the HII region GUM31

Resumen: We would like to observe the environs of a number of young stellar object (YSO) candidates located at the edge of the expanding HII region Gum31, with the aim at investigating the properties of the protostellar envelope and the molecular outflows, through observations of SiO(5-4), H₂CO(3-2), 12CO(2-1), C₁₈O(2-1), and 13CO(2-1) transitions. These molecules lines are sensitive to different excitation conditions, and evidence typical signatures of YSO circumstellar evolutionary stages. In addition, we would like to observe the emission at 345 GHz using LABOCA bolometer to characterize the surrounding cold dust related to these clumps. This project is part of a more extensive multifrequency research leading to improve the knowledge of the star formation activity in the environs of HII regions.

Tiempo asignado: 3.8 – 20.5 horas

Propuesta: 2011B-73B

Investigador Principal: Rodolfo Barba

Universidad: Universidad de La Serena

Título: Millimetric observations of the galactic nebula NGC 3503

Resumen: NGC 3503 is a optical emission nebula ionized by early B-type stars belonging to the open cluster Pismis 17 (from here onwards, Pis 17). NANTEN 12CO observations evidenced the presence of a molecular cloud at a velocity of ~ -25 km s⁻¹ associated with the nebula. The stars of Pis 17 seems to have disrupted the molecular gas and formed a photo-dissociation region (PDR) at the interface between the molecular and ionized gas, and a champagne flow in the oposite direction. Given the low resolution of the NANTEN data, we would like to observe the molecular emission in both, 12CO (2-1) and 13CO (2-1) lines, as well as high density molecular lines (CS (5-4) and HCN (3-2)) with the APEX-1 SHFI instrument. These observations would allow us to analyse and characterize the molecular gas related to NGC 3503. Physical parameters, such as axcitation temperatures, opacity, densities, and masses could be derived accurately. These observations would also allow performing a study of the molecular gas associated with the PDR at the interface between NGC 3503 and its molecular gas, and providing some information about star formation in the region.

Tiempo asignado: 15.8 horas

Propuesta: 2011B-65

Investigador Principal: Mónica Rubio

Universidad: Universidad de Chile

Título: Molecular Clouds at Low Metallicity.

Resumen: Assessing the molecular gas and how it is distributed into clouds is essential to understanding the processes that drive star formation, but CO is notoriously hard to detect at low metallicities. With our previous SHFI observations we matched the beam size to cloud size and pushed CO observations to the low metallicity dwarf galaxy WLM. In a proposal to ESO we have requested more time on the location of our tentative detection to increase the S/N and confirm the detection. If confirmed, this observation will break the low metallicity barrier for CO observations. In this proposal through Chile we are requesting additional CO pointings of WLM to explore cold dust as a potential tracer of molecular gas in metal-poor systems. A correlation between CO and dust that radiates at 870 μ m in the LABOCA passband has been observed in the Magellanic Clouds. We obtained a LABOCA image of WLM last year, and are requesting time now to obtain CO observations of two bright FIR regions in that map. If successful, these observations would open up the use of LABOCA-type images as tracers of molecular clouds in metal-poor dwarf galaxies.

Tiempo asignado: 40 horas

Propuesta: 2011B-66B

Investigador Principal: Michel Curé

Universidad: Universidad de Valparaíso

Título: Inspecting dust formation activity in the surroundings of WR 65 and WR 112

Resumen: The Wolf-Rayet stars WR112 & WR65 show excess IR fluxes thought to originate in hot dust formed in carbon-rich WR+OB massive binary system. The dense stellar winds collide in a bow-shock region defined by an equilibrium between the ram-pressures of the two winds. The high density of matter in this region allows dust to form, although details of the actual process are lacking. With the aim of providing unique constraints both on the amount of the circumstellar dust and on the dust formation mechanism in the binary systems, we propose to use the APEX telescope to observe the continuum dust emission at 870 & 350 μm , and the vibrationally excited CO emission $v = 1$, $J = 3 - 2$ and $J = 2 - 1$ at 342.6 and 228.4GHz. We request observing time of 4.7h with LABOCA and 12.1h with SABOCA to reach rms of 2, 4 mJy/beam, and 9 mJy/beam to have a 5_ detection, and 5.0h with SHFI to observe the lines at 1 km s⁻¹ resolution with rms down to 0.01 K.

Tiempo asignado: 11.8 horas

Propuesta: 2011B-62B

Investigador Principal: Mónica Rubio

Universidad: Universidad de Chile

Título: Dust, Molecules, and Star Formation at Low Metallicity.

Resumen: Dust affects the cooling cycle in the ISM and this affects the ability of a galaxy to form cold, dense clouds that can form stars. Thus, the low dust content of dwarf irregular galaxies should have consequences to the star formation process, but just what is the connection? We obtained a LABOCA 870 μm map of part of the low metallicity dwarf WLM and propose here to use LABOCA to map three more dwarf galaxies. These data will trace the cold FIR dust continuum emission of low metallicity systems, and reveal probable sites of molecular material. These data, in combination with our exquisite HI maps and star formation history maps, will allow us to examine the relationship between the dust content, gas, and star formation in a metal-poor dwarf galaxy. This will be important for understanding the evolution of dwarfs and star formation in the early universe.

Tiempo asignado: 26.8 horas
