



Comisión Nacional de Investigación  
Científica y Tecnológica - CONICYT

## Resultados del Concurso 2014B para Observaciones en Gemini-Sur

**Propuesta:** G/2014B/018

**Investigador Principal:** Tom Richtler, Universidad de Concepción

**Título:** Isolated ellipticals - key objects for the dark matter problem?

**Resumen:** The nature of dark matter is one of the deepest mysteries in astrophysics. The cold dark matter paradigm has its successes in cosmology, but faces challenges on the galaxy scale. Alternative concepts have their successes in modelling rotation curves and explaining the tight baryonic Tully-Fisher-relation. Isolated elliptical galaxies, not being exposed to external fields and often late mergers, are key objects. We already found objects at odds with cosmological simulations and perhaps will find more. Here we propose to investigate the isolated ellipticals NGC 1162 and NGC 2865 using globular clusters and the technique of ultra-deep mask spectroscopy.

**Tiempo asignado:** 10 horas.

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**Propuesta:** G/2014B/020

**Investigador Principal:** Neil Nagar, Universidad de Concepción.

**Título:** A kinematic Survey of the Narrow Line Region in nearby Active Galaxies

**Resumen:** Although recognized as an important component of Active Galactic Nuclei (AGN) - e.g., AGN 'feedback' on ISM via ionizing radiation and winds - the fundamental nature of the Narrow Line Region (NLR) remains poorly understood. Early studies of 'prototypical' nearby AGN led to the picture of a cone shaped NLR region composed of outflowing gas. However, recent modeling (using long-slit spectroscopy) shows that conical outflows are present in only 1/3 of the cases. In general, NLR kinematics are complex and ambiguous; disentangling the multiple components requires two-dimensional spectroscopic mapping. We thus propose a GMOS-IFU survey of the NLR kinematics in a well-defined, distance-limited sample of (30) nearby AGN, selected for showing extended [OIII]5007A emission and a range of AGN luminosities. Ten AGN have been mapped by us, five are proposed here, and five will be proposed in 2015A. Parallel proposals (M.Elvis; US) will request 10 AGN on Gemini-N. Our goals are to: (1) separate distinct kinematic components: rotation in the galaxy disk, inflows and outflows; (2) determine the geometry, extent and inclination of the outflow; (3) obtain mass inflow and outflow rates; (4) determine the kinetic power of the outflow to gauge its impact on the galaxy; (5) correlate all these properties with the AGN luminosity. Each proposed AGN is individually publishable (Slater's thesis), and the final sample will allow firm statistical conclusions and leverage unique followups with ALMA.

**Tiempo asignado:** 7.5 horas.

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**Propuesta:** G/2014B/008

**Investigador Principal:** Adam Hardy, Universidad de Valparaíso.

**Título:** The first detection of a second-generation substellar companion

**Resumen:** Images with the GPI instrument in the K2-coron and H-coron mode are requested of the post-common envelope binary (PCEB) V471 Tau. There is strong evidence this system hosts a brown dwarf, and direct imaging is now possible thanks to the sensitivity of GPI. If successful, this would be the first confirmed second generation substellar companion, and will represent a breakthrough not only for the interpretation of period variations in PCEBs, but also for planet formation theories and brown dwarf research.

**Tiempo asignado:** 2 horas.

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**Propuesta:** G/2014B/042

**Investigador Principal:** Sebastian Perez, Universidad de Chile.

**Título:** Mapping the protoplanetary disk in EP Cha: planet formation and dust evolution at a critical age.

**Resumen:** At a critical age of 8 Myr, disks in the eta Cha association of low luminosity stars should have lost most of their primordial circumstellar gas. In fact, at this age these disks are assumed to be young debris disks. Interestingly, some of these debris disks show strong accretion and appreciable quantities of gas have been detected, challenging the idea that most disks lose all their gas at a rather early age. EP Cha, the target of this proposal, is one of those disks. At only 97 pc away, EP Cha represents an ideal lab to study planet formation at the critical age of 8 Myr. We propose to take a closer first look at EP Cha's disk with the superb high-contrast capabilities of the Gemini Planet Imager (GPI). Resolved imaging in scattered light can tell us about the disk flaring and dust settling, along with a reliable estimate of its size. Our goals are: 1) to map the disk's surface brightness in scattered light, determine its sizes and whether they are flaring, and 2) to directly pinpoint planetary mass companions.

**Tiempo asignado:** 1.5 horas

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**Propuesta:** G/2014B/043

**Investigador Principal:** Lucas Cieza, Universidad Diego Portales.

**Título:** GPI observations of Young, Nearby, and Dusty A-type Stars

**Resumen:** We propose to use the recently commissioned Gemini Planet Imager (GPI) to observe 5 young (age 10-100 Myr) and nearby ( $d \sim 46-100$  pc) A-type stars with very prominent debris disks to both image their disks and search for planets. These types of targets provide plenty of photons to image debris disks in scattered light and are also the hosts of most of the known giant planets in wide orbits ( $a \sim 10-100$  AU). We will perform coronagraphic observations in the K-band to detect giant planets with masses as low as 2-3  $M_{\text{Jupiter}}$ . We will also obtain polarimetric observations in the H-band to investigate the structures of the disks: the radial location of the dust, and any azimuthal variations, warps, and/or offsets with respect to the central stars produced by planets.

**Tiempo asignado:** 8 horas.

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**Propuesta:** G/2014B/036

**Investigador Principal:** Marcelo Mora, Pontificia Universidad Católica de Chile.

**Título:** Zooming into the recent star formation event in the infalling dwarf Irregular galaxy NGC 1427A

**Resumen:** Ram pressure stripping is one of the possible mechanisms by which peripheral dwarf irregulars and gas rich galaxies transform into the dwarf spheroidals observed inside of galaxy clusters. Galaxies at intermediate and final stages of dwarf irregular-dwarf spheroidal transformation show gas clumps, tidal tails and young objects, plus quenched star formation in the main galaxy body. Early stages are recognized by distorted shapes, supersonic infalling speed and recent star formation events where the newly formed objects group themselves in entities known as star cluster complexes. We propose to zoom into the properties of two newly formed star cluster complexes (and its surrounding media) located in an apparent tidal field of NGC 1427A as a representative sample of the local conditions in a galaxy that it is starting its dwarf irregular-dwarf spheroidal transformation in its way toward the center of Fornax galaxy cluster.

**Tiempo asignado:** 10 horas.

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**Propuesta:** G/2014B/048

**Investigador Principal:** Christopher Haines, Universidad de Chile

**Título:** LoCuSS: Pre-processing within X-ray-selected groups infalling into  $z \sim 0.2$  clusters

**Resumen:** Galaxy clusters assemble at late epochs, accreting a significant fraction of their mass and galaxy populations in the form of infalling galaxy groups. Measuring the rate at which clusters are accreting mass via groups is important both for cosmology but also the energy balance of their intra-cluster medium. Equally, "pre-processing" of star-forming spirals within infalling groups provides a promising explanation for the shortfall of star-forming galaxies observed at large cluster-centric radii, and the rapid decline in star formation among cluster galaxies since  $z \sim 0.5$ . We propose a GMOS-N/S spectroscopic survey of 12 X-ray selected groups already confirmed to be infalling into massive clusters at  $z \sim 0.2$ , to provide redshifts for 20-35 members per group. This will allow us to estimate group masses and their contribution to cluster growth, as well as quantify the relevance and effects of pre-processing on the evolution of star formation among the cluster galaxy population.

**Tiempo asignado:** 6 horas.

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**Propuesta:** G/2014B/007

**Investigador Principal:** Dave Jones: Universidad de Atacama

**Título:** Determining Stellar Parameters of Eclipsing Binary Central Stars of Planetary Nebulae

**Resumen:** Binary central stars of planetary nebulae are valuable tools with which to study the evolution of close binary systems. We propose to obtain orbit-resolved spectra of three eclipsing binary central stars of planetary nebulae in order to determine the physical parameters of those systems and add to a small number of already well-analyzed systems. The study of these binary systems has direct impacts on a number of astrophysical studies including common envelope evolution, the ejection and shaping of planetary nebulae, formation of cataclysmic variables, and the formation of Type IA supernova progenitors.

**Tiempo asignado:** 2.3 horas

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**Propuesta:** G/2014B/035

**Investigador Principal:** Paulina Lira, Universidad de Chile

**Título:** Reverberation Mapping of high-z QSOs: the final stages

**Resumen:** Reverberation mapping provides the only tool for obtaining the Black Holes (BH) mass in Active Galaxies. So far this method has been successfully applied only to low and intermediate luminosity systems ( $< 10^{46}$  ergs/s). We are extending these studies by two orders of magnitude, probing the BLR size (and BH-mass) of luminous AGN at redshift  $\sim 2-3$ , the peak of the Quasar era. Such large, slowly varying systems require a monitoring strategy that will maximise the likelihood of detecting significant variability. Since 2006 we have been monitoring a few dozen very luminous Quasars using broad band imaging with the SMARTS consortium. Targets with significant variations have been followed up with the du Pont telescope covering Ly $_{\alpha}$ , SiIV, CIV and CIII. Now we have identified a handful of sources with significant structure in their continuum and line curves which are very promising to deliver BH mass determinations in the next few years of monitoring. With this proposal we want to add the crucial low-ionization MgII line observed at  $\sim 10,000-10,600$  Å, and in some cases H $\beta$  at  $\sim 17500$  Å, to our monitoring campaign using the long slit capability of F2. Given the brightness of our sources, this would be a very economic proposal with a high scientific return.

**Tiempo asignado:** 1.5 horas

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**Propuesta:** G/2014B/049

**Investigador Principal:** Valentin Christiaens, Universidad de Chile.

**Título:** Companions and spiral arms in the disk of Herbig AeBe disks with large gaps

**Resumen:** Observations of accreting protoplanets are required to constrain theories of planet formation and its feedback onto disk evolution. Recent progress suggests that core-accretion could occur efficiently in the outer regions of disks hosting large gaps. Such gaps are thought to be sculpted by massive giant planets. These putative bodies are also thought to be at the root of spiral patterns, which have indeed been seen in the outer disks beyond the gaps. GPI allows state-of-the-art imaging of large protoplanetary cavities, and the detection of these long-sought protoplanets near the gaps' edges or in the outer disks. We will search for planetary companions in direct imaging, complementing the default angular differential coronagraphic-imaging mode with reference-star differential imaging. Polarimetric differential imaging will provide images of the protoplanetary gaps and test the occurrence of spiral patterns.

**Tiempo asignado:** 4 horas

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**Propuesta:** G/2014B/017

**Investigador Principal:** Hanindyo Kuncarayakti, Universidad de Chile

**Título:** GMOS-S IFU spectroscopy of nearby supernova explosion sites

**Resumen:** We propose GMOS-S IFU spectroscopy of nearby core-collapse supernova (SN) sites within  $cz < 1500$  km/s to derive constraints on the mass and metallicity of the SN progenitors. The use of IFU enables us to obtain both spatial and spectral information of the SN explosion site simultaneously, providing valuable insight to the SN immediate environment. The observed spectrum of the SN parent population will be compared to simple stellar population (SSP) models to derive its age and metallicity, which in turn give the initial mass and metallicity estimate of the once coeval SN progenitor star. Metallicity

will be derived using the strong line method and H-alpha equivalent width will be used to estimate the age. In terms of the physical size of the studied area of SN environment, our method is in-between pre explosion direct progenitor imaging and SN host galaxy studies, but provides accuracy in progenitor mass estimate comparable to direct progenitor detection as well as having the advantage of metallicity determination. This is important in the context of hydrogen-free SN progenitors, which are thought to have lost the hydrogen envelope via metallicity-driven winds. This project will provide reliable estimate of SN progenitor initial mass and metallicity, and shed light on the question of mapping different SN types with their respective progenitors. As mass and metallicity are the two governing parameters of massive star evolution, this study is important to link massive star evolution with their endpoint products as supernovae.

**Tiempo asignado:** 9 horas

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**Propuesta:** G/2014B/034

**Investigador Principal:** Paul Eigenthaler, Pontificia Universidad Católica de Chile

**Título:** Spatially resolved stellar population parameters of three fossil group first-ranked galaxies

**Resumen:** Fossil galaxy groups, defined as extended, luminous X-ray sources ( $L = 0.5 \times 10^{42} \text{ h}^{-2} \text{ erg s}^{-1}$ ) with a giant elliptical galaxy dominating the optical with a greater than 2 magnitude gap between the brightest and second brightest galaxy, are considered to be the end-product of multiple mergers in the group environment. Based on this paradigm, the merger history of the progenitor group is expected to be imprinted in the first-ranked central galaxy. The question is then: does the formation process of fossil groups create significant differences in the stellar populations of their first-ranked galaxies when compared to those for non-fossil bright cluster galaxies (BCGs). To address this question, we propose deep long-slit spectroscopy for a sample of three nearby fossil BCGs with GMOS to measure the spatially resolved stellar population parameters log age,  $[Z/H]$ ,  $[Fe/H]$ , and  $[\alpha/Fe]$  with unprecedented accuracy to derive their formation history.

**Tiempo asignado:** 20 horas.

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**Propuesta:** G/2014B/013

**Investigador Principal:** Ricardo Demarco, Universidad de Concepción

**Título:** Spectroscopic confirmation of an evolved galaxy cluster candidate at  $z=2.3$

**Resumen:** We plan to confirm one of the strongest, most promising cluster-like overdensities in the COSMOS field, a high spatial concentration of passive galaxies at  $z \sim 2.3$ , which might be the highest redshift galaxy cluster found to date. To identify this object, we have derived for the first time a high contrast/fidelity 3D map of the large scale structure (LSS) at  $z > 1.5$  in the COSMOS field, as traced by quiescent galaxies, using new photometric redshifts specifically tuned on spectroscopically confirmed high-redshift passive sources. We propose to use 13.5h of GMOS-S spectroscopy to target star-forming galaxies likely associated with the overdensity, in order to confirm its cluster nature and its redshift. This will also validate our highredshift LSS mapping traced by massive passive galaxies, and thus in turn enable a more detailed investigation of structure growth, and its role in the evolution of galaxies in different environments at early times.

**Tiempo asignado:** 13.5 horas.

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**Propuesta:** G/2014B/050

**Investigador Principal:** Franz Bauer, Pontificia Universidad Católica de Chile

**Título:** Resolving the peak of the Cosmic X-ray Background: Optical Follow-up for the NuSTAR Serendipitous Survey

**Resumen:** A key goal of high-energy astrophysics is to determine the detailed composition of the cosmic X-ray background (CXB) at  $\sim 20\text{--}30$  keV in order to understand the evolution of AGNs. NASA's recently launched NuSTAR, the first focusing X-ray observatory with good sensitivity between 3-79 keV, provides a major breakthrough in studying the CXB through targeted extragalactic deep-field and serendipitous surveys. To obtain a full census of these sources, however, requires optical redshifts and classifications. Here we propose for GMOS observations in 2014B to obtain modest resolution spectra for southern targets from the serendipitous component of the NuSTAR wedding-cake CXB survey. Redshifts and spectral classifications are needed to characterize this complete sample of hard X-ray selected AGN and model the hard CXB population in detail.

**Tiempo asignado:** 5 horas.

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**Propuesta:** G/2014B/023

**Investigador Principal:** Nuno Peixinho, Universidad de Antofagasta

**Título:** Searching for the primordial proto-planetary gradient through cis-Plutino resonant Kuiper Belt Objects

**Resumen:** Kuiper Belt Objects (KBOs) constitute a vast disk of pristine icy objects orbiting beyond Neptune. Their present orbital structure indicates that giant planets have migrated in the past. The idea of the existence of a primordial compositional heliocentric gradient that should have been reflected in the surface properties of these objects has been considered as obvious but remains to be proven. Not only strong orbital mixing of objects originating in different parts of the primordial disk are expected, but also surface evolution processes may have erased their primordial surface properties, making the task of tracing back this gradient quite difficult. However, during the outwards migration of Neptune a specific group of orbitally stable resonant KBOs should have captured objects from distinct parts of the primordial disk without significant "contamination" from other regions. Therefore, if a primordial gradient existed it should be preserved in those resonant objects. Out of 43 only 16 have been measured. Our goal is to observe 22 more, 10 of which during this call. Sampling their properties will allow us, finally, to either trace back information on the primordial gradient or conclude that surface processing mechanisms have essentially erased that information.

**Tiempo asignado:** 6.2 horas.

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**Propuesta:** G/2014B/011

**Investigador Principal:** Doug Geisler: Universidad de Concepción

**Título:** Accurate Ages, Metal Abundances and Kinematics of a Large Sample of Small Magellanic Cloud Star Clusters and Surrounding Fields

**Resumen:** We propose to derive ages, metallicities and velocities, for red giants in 11 star clusters in the Small Magellanic Cloud (SMC). Simultaneously, we will obtain similar data (except for ages) for a number of field stars surrounding each cluster. The Ca triplet efficiently yields excellent velocities and metallicities, and CMDs from preimages provide ages. SMC clusters are an ideal laboratory for unlocking the secrets of cluster and galaxy formation, and are crucial testbeds for stellar evolution models and interpreting the integrated light of distant galaxies. Despite its proximity, the SMC has been neglected and we still lack a comprehensive knowledge of its chemical evolution, which should be greatly aided by this investigation. We will compile a definitive dataset for the age-metallicity relation (AMR), metallicity distribution and possible gradients. We will investigate if cluster formation has been continuous or bursty, and compare the AMR to models. Our much larger sample of field giants currently available permits comparison of chemical evolution in clusters to the field. Velocities yield the kinematics of both the clusters and field giants, which are important for understanding the structure and formation of this nearby but poorly studied galaxy.

**Tiempo asignado:** 11 horas.

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**Propuesta:** G/2014B/030

**Investigador Principal:** Jesús Corral Sanatana: Pontificia Universidad Católica de Chile

**Título:** Revealing the nature of unidentified gamma-ray sources

**Resumen:** In the last 4 years, the number of known gamma-ray sources increased of 60% (from 1873 to 3055 objects) thanks to the new stacked analysis of observations obtained with the gamma-ray Large Area Telescope (LAT) on board the Fermi satellite. The great majority of these sources (56%) are blazars (AGNs whose relativistic jets points towards the Earth). Unfortunately, the lack of optical spectroscopy for 20% of these objects (classified as unidentified AGNs) prevent the full exploitation of the data. The knowledge of the spectral classification and distance redshift of candidate blazars allows to constraint physics of the relativistic jets, the central engine, the emission models, as well as constrain the extragalactic background light (EBL) models. We propose a series of optical spectroscopic observations in order to classify a large sample of this unknown objects and to measure their distance using emission or absorption line.

**Tiempo asignado:** 3.4 horas.

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**Propuesta:** G/2014B/009

**Investigador Principal:** David Rodriguez, Universidad de Chile

**Título:** Characterizing Young Stars Near the Earth

**Resumen:** Recent work has led to the discovery of many young stars (ages  $<100$  Myr) in moving groups less than 100 pc from the Earth. Our own research with the GALEX and WISE satellites has revealed many candidate young, low-mass stars throughout the whole sky. The measurement of spectral features such as H $\alpha$  and Helium emission as well as Lithium and Sodium absorption are key in estimating the ages of these late-type stars. We propose to use GMOS-S on the Gemini telescope to identify spectral features of youth for a sample of young star candidates that may be members of nearby moving groups with ages of  $\sim 10$ -100 Myr. At present, the low-mass membership of these groups is poorly constrained; this proposal directly addresses this objective. Furthermore, it is important to pursue a more complete census of young, low-mass stars near Earth that can serve as excellent targets for direct imaging searches of young, massive planets.

**Tiempo asignado:** 10 horas.

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