Fellow Symposium 2009
June 8 - 10
ESO Garching

List of Contributions

Andrea Ahumada

Integrated spectroscopy of star cluster

We present flux-calibrated integrated spectra in the optical spectral range (3600-6900 Å) of Galactic open clusters and Magellanic Clouds stellar clusters obtained at CASLEO (Argentina). We estimate simultaneously age and foreground reddening by comparing the continuum distribution and line strengths of the cluster spectra with those of template spectra. The present data led us to upgrade the spectral library of reference spectra or templates which will be useful for several astrophysical applications.

Alvaro Alvarez-Candal

Observational constraints to the models of the architecture of the trans-Neptunian region.

Two recent models describe the architecture of the outer Solar System based on radically different phenomena. On one hand, The Nice model (Tsiganis et al. 2005, Levison et al. 2008) starts from a compact model of the Solar System, not extending beyond 30 AU, and relies on the effects of the crossing of the 1:2 mean motion resonance between Jupiter and Saturn, as well as a high temporal eccentricity of Neptune. On the other hand, the X-planet model (Lykawka & Mukay 2008) makes use of an, yet unseen, trans-Plutonian planet which, together with the giant planets, perturbed the outer Solar System. This model does not make use of a compact version of the Solar System.

The different mechanisms described in the models obtain a remarkably similar final trans-Neptunian belt (TNB). Anyhow, the models differ on the original location of the bodies that today inhabit the TNB. Therefore, the main objective of this presentation is to discuss how our current observational understanding of the TNB will complement these, or other, dynamical models.

Giuseppina Battaglia

Chemo-dynamics of galaxies from resolved stellar population studies in the surroundings of the Milky Way and beyond

The immediate surroundings of the Milky Way hosts several examples of dwarf spheroidal galaxies (dSphs), which are among the smallest and faintest galaxies in the Universe. From a cosmological point of view, dSphs are good testing grounds for dark matter theories of galaxy formation, being the most dark matter dominated objects known to-date; furthermore, dSphs are simple with respect to larger galaxies, with no features such as bars or spiral arms which may add complications to the interpretation of their internal properties, and therefore should be easier to understand and model.

With the current instrumentation, these objects can be studied in great detail in the surroundings of the Milky Way, on a star-by-star basis. Wide-area imaging and intermediate resolution spectroscopic of hundreds individual stars have by now been acquired for several of the dSphs satellites of the Milky Way. This has provided a detailed observational picture which has in turns allowed improved modeling of the properties of these objects.

In this presentation I will show results from my work, within the DART project, on the determination of the metallicity, internal kinematics and mass content of a sample of Milky Way dSphs, and I will present also results from N-body and hydrodynamical models aimed at modeling the general properties of these galaxies. Finally, I will present an outlook on resolved stellar population studies beyond the Milky Way with the E-ELT.

Yuri Beletsky

DIBs and Ca-Fe interstellar clouds

Identification of numerous spectral features, known as diffuse interstellar bands (DIBs) is one of the longest standing unsolved problem of spectroscopy. The chemical analysis of diffuse interstellar clouds leads us to a discovery of a new class of objects -- Ca-Fe interstellar clouds. They turn out to be rare (just a few examples among ~300 lines of sight) objects with the CaI 4227 Å as well as FeI 3720 Å and 3860 Å lines stronger than those of KI (near 7699 Å) and NaI (near 3302 Å), occupying volumes different from the well-known interstellar HI clouds where the KI and ultraviolet NaI lines are dominant features. We have found the CaFe clouds only along sight-lines toward hot, luminous (and thus distant) objects with high rates of mass loss. In principle, the observed gas-phase interstellar abundances reflect the combined effects of the nucleosynthetic history of the material, the depletion of heavy elements into dust grains and the ionization state of these elements which may depend on irradiation by neighboring stars.

Thomas Bensby

Chemical evolution of the Galactic bulge as traced by microlensed dwarf stars

I will present new results from our ongoing project regarding the origin and chemical evolution of the Galactic bulge. Our results are based on high-resolution spectroscopic observations of dwarf stars in the bulge that are observed whilst being optically magnified through gravitational microlensing.

Stéphane Blondin

Determining extra-galactic distances (and the Hubble constant) using core-collapse supernovae

Recent progresses in modeling hydrogen-rich core-collapse supernova (SN II) spectra have led to a revived interest in these objects as extragalactic distance indicators. The angular size and photospheric radius of a supernova, and thus its angular-diameter distance, can be constrained to better than 10% by model atmosphere fits to multiepoch spectrophotometric observations. Such direct distance determinations are completely independent of any distance ladder, and are largely devoid of systematic errors. Applying this method to SN II in the Hubble flow can thus provide a direct and independent determination of the Hubble constant. I will discuss the method, some recent results, and plans for an observational program using VLT+Xshooter to determine the Hubble constant to 5-10% using a sample of SN II.

Lise Christensen

Lya emission from DLA galaxies

Damped Lyman-alpha (DLA) lines seen in quasar spectra belong to neutral hydrogen clouds with high column densities and likely originate in proto galaxy disks. A major fraction of the neutral gas throughout the Universe is contained in DLAs, and hence they serve as reservoirs for formation of stars. Yet the galaxies in which the DLA clouds reside remain to a large degree undetected. I will present the results from a survey with integral field spectroscopy aimed to detect the Lya emission lines from the galaxies that give rise to the absorption systems. The aim is to quantify if metal rich DLAs or those selected specifically through having strong carbon fine structure lines are more frequently associated with Lya emitting galaxies.

Blair Conn

Streams in the Outer Disk: A close look at the Monoceros Ring

The Outer Disk of the Milky Way is replete with substructure, many of which have been discovered through the Sloan Digital Sky Survey. I will provide a brief census of the known streams and focus on my particular interest, the Monoceros Ring. The Monoceros Ring is the largest substructure in the Outer Disk, aside from the Sagittarius Dwarf Spheroidal tidal stream found in the Halo, and remains somewhat of a mystery. After presenting the known properties of the Ring and discussing the various scenarios proposed to explain its origins I will conclude with explaining the observing approach required to break the deadlock.

Gayandhi De Silva

Abundance patterns of open clusters and moving groups in the Galactic disk

The long term goal of large-scale chemical tagging is to use stellar elemental abundances as a tracer of dispersed substructures of the Galactic disk. The identification of such lost stellar aggregates and the exploration of their chemical properties will be key in understanding the formation and evolution of the disk. Present day stellar structures such as open clusters and moving groups are the ideal testing grounds for the viability of chemical tagging, as they are believed to be the remnants of the original larger star-forming aggregates. Until recently, high accuracy elemental abundance studies of open clusters and moving groups having been lacking in the literature. Using newer high resolution studies, I will discuss the various elemental abundance patterns among the open cluster population of the Galactic disk and reassess the prospects of large-scale chemical tagging.

Jörg Dietrich

Cosmology with the shear-peak statistics

Weak gravitational lensing has initially been hailed as a method for constructing purely mass-selected galaxy cluster samples. It has however become increasingly clear in recent years that weak-lensing cluster catalogs are in fact shear-selected, not mass-selected. As such they are neither complete nor pure catalogs, complicating their application to cosmology.

We investigate the potential of the shear-peak statistics to provide cosmological constraints. Instead of concentrating only on shear peaks caused by collapsed halos we also consider convergence peaks caused by projections of the large-scale structure as carrier of cosmological information. We populate the Omega_m-sigma_8 plane with N-body simulations through which we perform ray-tracing and simulate observations with a tomographic peak finder. Such simulations can be tuned to closely match parameters of real surveys and can be made to include a variety of observational effects like e.g., masking of areas affected by bright stars.

We find that the shear-peak statistic gives constraints on Omega_m and sigma_8 competitive with two-point cosmic-shear tomography. We discuss the potential of the shear-peak statistics to break the Omega_m-sigma_8 degeneracy of cosmic shear and to constrain other cosmological parameters.

Michaela Döllinger

Hunting for extrasolar planets around G-K giants

G-K giants host planetary companions indicated by radial velocity (RV) variations in the stellar spectra. These stars show also evidence of oscillations (the so-called short-term RV variability) which can be used to determine additional stellar properties. For a sample of 62 very bright K giants, spectra in the visual range with and without an iodine cell were obtained with the high resolution coudé échelle spectrograph mounted on the 2m telescope of the Thüringer Landessternwarte Tautenburg (TLS). Moreover around 300 G-K giants were monitored with HARPS.

The Tautenburg survey contains at least 6 stars (around 10%) which show low-amplitude, long-period RV variations most likely due to planetary companions. The first preliminary results of the HARPS study confirm this planet frequency. Moreover the TLS survey and a previous study with FEROS (Setiawan et al. 2004) seem to indicate, that giant planets around giant stars are fairly common and do not favour metal-rich stars. The last result is in contrast to what is observed among main sequence (MS) stars.

Andrew Fox

Studying High-Redshift Galaxies in Absorption

Abstract: Quasar absorption-line systems contain a wealth of information about the development of cosmic structure. The highest column density absorbers, known as damped Lyman-alpha (DLA) systems, arise in the disks and halos of foreground galaxies. DLAs offer a luminosity-independent view of galaxy evolution from z~5 to z=0. I will present recent results on highly-ionized and molecular gas in DLAs, including observations of DLAs in gamma ray burst (GRB) afterglow spectra, which trace the ISM in the GRB host galaxies.

Diego Garcia

Correlations and properties of HI-selected galaxies

We have used the Parkes Multibeam system and the Sloan Digital Sky Survey to assemble a sample of 195 galaxies selected originally from their HI signature to avoid biases against unevolved or low surface brightness objects. For each source nine intrinsic properties are measured homogeneously, as well as inclination and an optical spectrum. The sample, which should be almost entirely free of either misidentification or confusion, includes a wide diversity of galaxies ranging from inchoate, low surface brightness dwarfs to giant spirals. Despite this diversity there are five clear correlations among their properties. They include a common dynamical mass-to-light ratio within their optical radii, a correlation between surface brightness and luminosity and a common HI surface density. Such correlation should provide strong constrains on models of galaxy formation and evolution.

Mark Gieles

Star clusters

In this talk I will present results of observational and theoretical studies on the formation and evolution of star clusters.

Marc Huertas

Classification in large extragalactic surveys: estimating morphologies

I will present a new non-parametric method to estimate morphologies of high-redshift galaxies based on support vector machines and I will show some applications on field and cluster environments using ground (MegaCam/WIRCAM)and space facilities (HST). More precisely, I will discuss the results of a wide field study of 10 massive clusters at intermediate redshift (z~0.5) and a detailed study of the properties of blue early-type galaxies from z~1 in the COSMOS field.

Gaël James

Neutron-capture elements in Galactic globular clusters

Globular clusters have always been considered as natural laboratories to test different scenarios of Galactic chemical evolution. For a long time they were thought to host very homogeneous populations in terms of metallicities and also evolutionary tracks along their CMD. The long studied O-Na anti-correlation, as well as the recently observed multiple components in the MS or RGB branches of the most massive Galactic globulars, have progressively revealed that these object are in fact not so simple and not always so homogeneous. I will discuss the interest of observing neutron-capture elements in this context and present the latest results of an extensive analysis of heavy element abundances in 17 Galactic globular clusters using data obtained with the FLAMES-UVES spectrograph at the VLT.

Heidi Korhonen

Resolving starspots

The magnetic origin of the sunspots has now been known for 100 years. And even though other aspects of the solar magnetic activity created by the dynamo action have been studied for decades, there are still many open questions. For building a complete picture of the magnetic activity and dynamo operation in the Sun and other stars it is of utmost importance to investigate the whole parameter space. This can only be done by also observing the activity in other stars than our own Sun. This is a difficult task as most of the stars are only seen as point sources, and it is impossible to make beautiful spatially resolved images, as we can do in the solar case. In this talk I will discuss methods for studying starspots, and present recent results.

Daniel Kubas

AO imaging of planetary microlensing event

In standard ground based light curve monitoring in general the physical parameters of the lens and source system are often poorly constrained due to the crowdiness of the target fields. By using high spatial resolution AO imaging obtained with NACO the determination of the physical characteristics of planetary microlens candidates can be significantly improved.

Silvia Leurini

Early stages of massive star formation: the case study of IRAS 17233-3606

Although massive stars are fundamental for astrophysics, little is known of their earliest evolutionary phases. The main problem for the understanding of massive star formation comes from the radiation pressure that massive stars exert on their surrounding medium, and that should even prevent further accretion into the star. One of the fundamental observational tests to distinguish between the different proposed models is to detect a system collimated outflow-accretion disk from a massive young stellar object (YSO), and, once detected, to access the fraction of still embedded massive YSOs with disks. Since massive pre-main sequence stars may lose any disk they originally had due to the radiation field, such studies are best done in earlier evolutionary phases. However, large distances and a high degree of multiplicity among early spectral type stars make observations of early evolutionary phases of massive YSOs a challenge, especially at (sub)mm wavelengths where current facilities still lack the necessary resolution to resolve single objects.

In my talk, I will present high angular observations with the SMA of the massive star formation IRAS 17233-3606 aimed at studying the powerful molecular outflow originating from the central protostar(s).

Margaret Moerchen

Snapshots of debris disk evolution with high-resolution thermal imaging

We have recently completed an imaging survey of debris disks at mid-infrared wavelengths. The goal of this program was to detect asymmetrical structures that would indicate a physical process sculpting the disk, such as a catastrophic planetesimal collision that generates a bright region of newly-formed dust, or a clump of dust that is trapped in an orbital resonance with a giant planet. Approximately one third of A-type stars host dusty disks undergoing processes like these, and we can locate such systems by detecting excess infrared emission around stars with ages larger than expected timescales for dissipation of the primordial disk material. We infer from the sustained presence of the dust that it must be resupplied through collisions of already-formed planets and planetesimals or through the sublimation of cometary bodies.

With mid-infrared cameras at the Gemini 8-meter telescopes, we obtained high spatial resolution (<0.5") images of the thermally emitting dust in more than 20 debris disk candidates (some of which are now known not to be debris disks), and in most cases we did not detect any brightness asymmetry nor was the source even spatially resolved. However, among the resolved disks, we have discovered several structures that may be analogous to those in our own solar system, such as asteroid belts and a snow line. One brightness asymmetry is seen, in the disk of HR 4796A, and we have determined that the bright side of the disk is also hotter than the opposite side. We are currently investigating the possible origins of such a temperature asymmetry in the dust disk, such as pericenter glow and resonant trapping. More generally, two disk archetypes are observed among the spatially resolved disks in this sample: Kuiper Belt analogs (four) and asteroid belt analogs (two). The asteroid belt analog is a new archetype among the overall group of spatially resolved debris disks (numbering <20), and its impact on descriptions of planetary system architecture will be better understood as the sample of resolved disks grows.

Guillaume Montagnier

Exploring the brown dwarf desert using CORALIE and NACO/SDI

We take advantage of the CORALIE radial velocity survey to select solar type stars with radial velocity drifts that are compatible with brown dwarf companions at a separation compatible with the resolution of the Very Large Telescope. The ultimate goals of our survey is to directly detect brown dwarfs companions and derive the brown dwarf companion frequency around solar type star between 5 and 100 AU. 36 stars with long term radial velocity signature were observed using the Simultaneous Differential Imaging mode of the Adaptive Optics instrument NACO at the Very Large Telescope. We combine radial velocity analysis with imaging constraints to characterize detected and undetected companions of the stars of our sample. In our sample, we identify two object with minimum mass in the brown dwarf regime. 17 binary stars are detected among which a very low mass star just above the substellar limit. Nine of them appear to be very promising as no companion is detected and we set stringent constraint to estimate the number of brown dwarf among them. We expect that 7.75 ± 0.60 brown dwarfs companions are present in our sample. From this work, we conclude that $1.90 \pm 0.15\%$ of solar type stars with no stellar companion closer than 200 AU have a brown dwarf companion between 5 and 100 AU.

Nadine Neumayer

The co-evolution of black holes and galaxies

The centers of massive galaxies are special in many ways, not least because all of them are believed to host supermassive black holes. Since the discovery of a number of relations linking the mass of this central black hole to the large scale properties of the dynamically hot component of its host galaxy (bulge) it has become clear that the growth of the central black hole is intimately connected to the evolution of its host galaxy. However, for bulge-less galaxies, the situation is much less clear. Interestingly, these galaxies often host star clusters in their nuclei, and unlike black holes, these nuclear star clusters provide a visible record of the accretion of stars and gas into the nucleus. However, the presence of black holes and their relation to the nuclear star clusters (NCs) remains largely unknown. In this talk I will outline my ongoing projects on nuclear star clusters and might present brand new SINFONI data for a nuclear star cluster that actually harbours an active galactic nucleus.

Colin Snodgrass

Lumps of ice are cool

I will briefly review my work on the minor bodies of the Solar System: comets, asteroids and trans-Neptunian objects. Primarily I study these bodies through optical photometry, from this inferring their surface properties and bulk physical parameters (size, shape, density). Recent highlights include studying the mega-outburst of comet 17P/Holmes and the detection of water ice by photometric methods on the surfaces of TNOs too small for IR spectroscopy.

Thomas Stanke

News on protostellar jets in Orion and in the IRAS 17233-3606 infrared dark cloud

I present new results of observations of protostellar jets. In Orion, a previous survey for jets at infrared wavelengths has been extended and combined with a surveys for protostars carried out at mid-infrared wavelengths with Spitzer and at 1.3 millimeter continuum with the IRAM 30m telescope. I also report on progress in mapping the submillimetre CO counterparts of the outflows. The second part of the talk deals with the discovery of jets driven by low-mass protostars in an infrared dark cloud, a class of clouds usually studied for its association with high mass star formation. The jets are driven by deeply embedded, very young sources. The accumulation of very young sources along the filament is suggestive of star formation synchronized by an external trigger.

Masayuki Tanaka

High redshift galaxy clusters

Galaxies evolve differently in different environments. Red early-type galaxies are the dominant population in galaxy clusters, while galaxies in low-density field are typically blue late-type galaxies. We discuss physical processes driving the environment-dependent galaxy evolution. We made multi-band wide-field imaging of several high redshift galaxy clusters. We discovered prominent large-scale structures around them, some of which are spectroscopically confirmed. The prominent structures at high redshifts are an ideal site to examine the environmental variations of galaxy properties. We discuss photo-spectroscopic properties of galaxies as a function of environment in detail and address physical processes driving the environment-dependent galaxy evolution. The currently known highest redshift cluster is at $z=1.45$. $z>1.5$ is called redshift desert and there is no confirmed cluster there. We are now 'greening' the desert and we present some recent results if time allows.

Elena Valenti

Near-Infrared study of Galactic Bulge Stellar Populations

The study of the Milky Way bulge is tightly related to the problem of galaxies formation and evolution. In fact, being the nearest resolved stellar population that resembles more distant spheroidal populations of bulges and ellipticals - for which only studies of their integrated properties are possible - its main physical and chemical properties are key ingredients in galaxy formation and evolution models. I will briefly present the on-going project aimed at characterizing the Galactic Bulge cluster and field populations by means of high resolution near-Infrared spectroscopy and photometry.

Bram Venemans

Galaxies at z=7.7: results from DazLE

I will present results obtained with the VLT visitor instrument DAzLE (Dark Ages z Lyman-alpha Explorer), a specialised ultra-narrow band (R=1000, FWHM=1nm) wide-field near-infrared camera optimised to detect faint emission lines between the intense OH airglow lines that dominate the sky background at 1.0-1.8 micron. Between 2006 and 2008 data was taken with DAzLE on three different observing runs. We targeted both blank fields and massive clusters, to search for lensed Lyman alpha emitters. I will give an overview of the data obtained, describe how candidate line emitters were selected and provide constraints on the z=7.7 luminosity function.

Irina Yegorova

Luminous and dark matter in spiral galaxies

Thanks to a wealth of observational data, in the past years the structural properties of dark and luminous mass distribution in spiral galaxies have been unraveled. In this context, our research group is using different techniques to study spirals at different radial scales. Based on an accumulated large sample of rotation curves, I will present the main results that we have obtained for galaxies of different mass and luminosity. These results clearly point at the fact that the mass distribution of spirals shows systematical properties. It has been firmly established that dark matter halos extend far beyond the optical boundaries of galaxies. However the real extent and distribution of halo dark matter outside galactic disks still remains unknown. To trace this distribution, we are using the satellites surrounding the galaxies of our sample. I will discuss the extension of dark matter halos, and the distribution of satellites around isolated spiral galaxies.