Star and planet formation Workshop, 21 January 2013

Session 1: Star formation, Astrochemistry and X-rays

9:20 - 9:30	Welcome and logistics	Catarina Alves de Oliveira (ESA)
9:30 - 9:40	Dense core formation in the Taurus Molecular Cloud.	Álvaro Hacar (Vienna)
9:40 - 9:50	Comparing star formation models with interferometric observations of the protostar NGC 1333 IRAS 4A. Magnetohydrodynamic collapse models.	Pau Frau (OAN)
9:50 - 10:00	Far-IR spectroscopy of protostars and star forming regions with Herschel.	Javier R. Goicoechea (CAB)
10:00 - 10:10	A line-confusion limited millimeter survey of Orion KL.	Belén Tercero (CAB)
10:10 - 10:20	Study of cyano(di)acetylene in Orion KL: detection of DC_3N.	Gisela Esplugues (CAB)
10:20 - 10:30	Organic molecules in the massive star forming region Orion-KL.	Alicia López Jiménez (CAB)
10:30 - 10:40	Vacuum-UV spectroscopy of interstellar ice analogs with a H_2 lamp as a continuum emission source. Measurements of the UV-absorption cross sections.	Gustavo Adolfo Cruz-Díaz (CAB)
10:40 - 10:50	Photoevaporation of protoplanetary disks by XUV stellar radiation.	Jorge Sanz-Forcada (CAB)
10:50 - 11:00	X-ray emission in star-forming regions.	Miguel Ángel López García (UCM)
11:00 - 11:30	Coffee/Tea break	

Session 2: Massive stars, T Tauri stars, brown dwarfs, and planets

11:30 - 11:40	RRLs as a tool to study ionized outflows and disks around massive stars.	Alejandro Baez-Rubio (CAB)
11:40 - 11:50	Mining the sky for accreting T-Tauri stars outside star-forming region cores.	Alexis Klutsch (UCM)
11:50 - 12:00	What can YOU do in σ Orionis?.	José Antonio Caballero (CAB)
12:00 - 12:10	Planetary mass brown dwarfs in young clusters.	Catarina Alves de Oliveira (ESAC)
12:10 - 12:20	The planetary-mass domain of the sigma Orionis cluster.	Mara Rosa Zapatero Osorio (CAB)
12:20 - 12:30	On a full confirmation and characterization of Kepler planet candidates.	Jorge Lillo-Box (CAB)
12:30 - 13:30	Discussion (questions to previous talks and open forum)	
13:30 - 15:00	Lunch break and coffee	

Session 3: Herschel, tools and JWST

15:00 - 15:10	Star formation and disk evolution in the Coronet cluster: the history of a sparse cluster.	Aurora Sicilia-Aguilar (UAM)
15:10 - 15:20	Herschel insight on circumstellar disc evolution: the GASPS project.	Pablo Rivière Marichalar (CAB/UAM)
15:20 - 15:30	Identification of transitional disks in Chamaeleon with Herschel.	Álvaro Ribas (CAB/ESA)
15:30 - 15:40	DUst around NEarby Stars (DUNES): description of the project and results.	Benjamín Montesinos (CAB)
15:40 - 15:50	A comprehensive X-Shooter survey of nearby star forming regions.	Beate Stelzer (Palermo)
15:50 - 16:00	Discovery of Brown Dwarfs and Subdwarfs using VO.	Miriam Aberasturi (CAB)
16:00 - 16:10	Searching for common proper-motion companions in the Local Association and its young kinematic subgroups.	Francisco J. Alonso-Floriano (UCM)
16:10 - 16:20	High precision astrometry from the ground: complementing Gaia.	Hervé Bouy (CAB)
16:20 - 16:30	The JWST Mid-IR Instrument (MIRI). A future new window into the star/planet formation processes.	Luis Colina (CAB)
16:30 - 17:00	Coffee/Tea break	
17:00 - 17:30	Discussion session	
17:30 - 17:40	Workshop adjourn	

Session 1: Abstracts

Dense core formation in the Taurus Molecular Cloud.

Álvaro Hacar (Vienna)

Characterizing the dense core formation is a critical step for our understanding of the star formation process within molecular clouds. Using different molecular tracers to study the gas kinematics at different scales and density regimes, we have investigated the dense core formation in two prototypical star-forming regions in the Taurus Molecular Cloud, namely the L1517 cloud and the B213/L1495 filament. In both regions, our results demonstrate that all the gas at densities of $n(H_2) \sim 10^3 - 10^4$ cm^{-3} is highly structured forming a complex network of velocity coherent filaments, typically with lengths of $\sim$0.5 pc and oscillatory-like and sonic velocity field. Moreover, our analysis reveals that all the dense cores are formed from these filaments inheriting their kinematic properties. Our observations then suggest that core formation in Taurus occurs in two steps. First, 0.5 pc-long velocity-coherent filaments condense out of the cloud gas, probably as a result of the turbulent cascade. And after that, and from these filaments, dense cores condense quasi-statically, likely due to gravitational instability when the filament has accumulated enough mass.

Comparing star formation models with interferometric observations of the protostar NGC 1333 IRAS 4A. Magnetohydrodynamic collapse models.

Pau Frau (OAN), Daniele Galli, Josep Miquel Girart

Observations of dust polarized emission toward star forming regions trace the magnetic field component in the plane of the sky and provide constraints to theoretical models of cloud collapse.

We compare high-angular resolution observations of the submillimeter polarized emission of the low-mass protostellar source NGC 1333 IRAS 4A with the predictions of three different models of collapse of magnetized molecular cloud cores.

We compute the Stokes parameters for the dust emission for the three models. We then convolve the results with the instrumental response of the Submillimeter Array observation toward NGC 1333 IRAS 4A. Finally, we compare the synthetic maps with the data, varying the model parameters and orientation, and we assess the quality of the fit by a χ^2 analysis.

High-angular resolution observations of polarized dust emission can constraint the physical properties of protostars. In the case of NCC 1333 IRAS 4A, the best agreements with the data is obtained for models of collapse of clouds with mass-to-flux ratio > 2 times the critical value, initial uniform magnetic field of strength ~ 0.5 mG, and age of the order of a few 10^4 yr since the onset of collapse. Magnetic dissipation, if present, is found to occur below the resolution level of the observations. Including a previously measured temperature profile of IRAS 4A leads to a more realistic morphology and intensity distribution. We also show that ALMA has the capability of distinguishing among the three different models adopted in this work.

Our results are consistent with the standard theoretical scenario for the formation of low-mass stars, where clouds initially threaded by large-scale magnetic fields become unstable and collapse, trapping the field in the nascent protostar and the surrounding circumstellar disk. In the collapsing cloud, the dynamics is dominated by gravitational and magnetic forces.

Far-IR Spectroscopy of Protostars and Star Forming Regions with Herschel.

Javier R. Goicoechea (CAB) and the WISH and HEXOS *Herschel* GT-Key Programmes.

In the earliest stages of evolution, protostars are deeply embedded in dense clouds of molecular gas and dust. Both the (gas) line and (dust) continuun emission from these regions peak at far-IR wavelengths. The far-IR spectral lines in particular are robust diagnostics of the energetic processes associated with the first stages of star formation (UV-illumination, shocks, etc.).

In this contribution we briefly discuss the complete far-IR spectra of individual low-mass protostars (e.g. Serpens SMM1) as well as larger scale maps of archetype high-mass Star Forming Regions in our galaxy (e.g. Orion and the Galactic Centre), all taken with the PACS, HIFI and SPIRE spectrometers on board *Herschel*.

A line-confusion limited millimeter survey of Orion KL.

Belén Tercero (CAB) and José Cernicharo (CAB)

In 2004 we started a line survey of Orion KL, the closest high mass star-forming region, with the IRAM 30-m telescope and its analysis is still open.

As a result of the interaction of newly formed stars with their environment, the physical structure and chemistry in this cloud is particularly complex. We have distinguished several spectral components in the line profiles that are characterized by different physical and chemical conditions. Each component reflects physical phenomena associated with high mass star formation: outflows and their interaction with the ambient cloud, hot cores, and possible explosions due to the interaction between stars in a complex system.

Within the frequency domains 80−115.5, 130−178, and 196−281 GHz (168 GHz bandwidth covered) more than 15,200 spectral features have been detected. We found a total of 45 molecules, including 191 different isotopologues and vibrationally excited states. Nowadays, more than 4500 spectral features are still unidentified. Owing to the large amount of data, we analyzed them dividing our studies into families of molecules Therefore, model development and discussions could be more focused. Many rotational transitions of the same molecule have been observed in different frequency ranges (the 3 mm window illustrates more clearly the ambient cloud, whereas the 1.3 mm one identifies the warmest gas), providing strong observational constraints on the source structure, gas temperature, gas density, and molecular column densities.

In collaboration with spectroscopy groups, we have provided 14 new detected species, all of them isotopologues and vibrationally excited states of well known molecules in this source improving, in addition, the molecular databases.

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8. Study of cyano(di)acetylene in Orion KL: detection of DC_3N.

Gisela Esplugues (CAB)

HC_3N is an excellent tracer of hot and dense regions affected by high exctinction; its vibrational levels can be excited by mid-IR radiation and the relatively low energy of the bending modes lets find them in many vibrationally excited states. Deuterated cyanoacetylene is considered also a good tracer of pre-star dense cores, but always it has been observed in dark clouds. Here we report the first detection of DC_3N in Orion KL (a hotter, denser and more evolved environment) and we present a study of HC_3N in this region with 2x2 maps around IRc2 and with the detection of 36 lines of its ground state and more of 200 lines of its isotopologues and vibrational states ν_7, $2\nu_7$, $3\nu_7$, ν_6, ν_5 and $\nu_6+\nu_7$, observed with the IRAM 30-m telescope (80-280

GHz) and the *Herschel* HIFI instrument (480-1910 GHz). We have also searched for HC_5N and found that the abundance ratio HC_3N/HC_5N is a factor about 10 larger than in dark clouds. A comparison of DC_3N with HC_3N provides an abundance ratio D/H=0.013 which implies a deuterium enrichment.

Organic molecules in the massive star forming region Orion-KL.
Alicia López Jiménez (CAB)

The chemistry composition of ISM is linked to the evolution of stars; different phenomena of star formation are associated to specific chemical compounds, and/or their abundances. The different stages of the molecular life cycle allow us to know the evolution, physical and chemical conditions of the astrophysical source. So, the chemistry surrounding high-mass star forming regions is studied based on the rotational line emission coming from an amount of molecules which trace the source in the millimeter-wave domain. As many observed lines arise from vibrationally excited states of abundant species for which spectroscopic constants are still lacking, laboratory measurements are needed to fully characterize the observed spectrum in the astrophysical sources. Several organic molecules with a dense rotational spectrum, such as methyl formate, ethyl cyanide, vinyl cyanide, are studied making a theoric simulation of the emission of their rotational lines and comparing them with observations of Orion-KL with the IRAM 30m radiotelescope.

Vacuum-UV spectroscopy of interstellar ice analogs with a H_2 lamp as a continuum emission source. Measurements of the UV-absorption cross sections.
Gustavo Adolfo Cruz-Díaz (CAB), Guillermo Muñoz Caro (CAB), Yu-Jung Chen

We report new results on vacuum-ultraviolet spectroscopy of interstellar ice analogs. It is performed using, for the first time, a continuum emission source, i.e. the H_2 lamp commonly used in most astrochemistry labs for UV irradiaton of ices. Pure ice samples composed of CO, CO_2, H_2O, CH_3OH, NH_3, CH_4, or N_2 were deposited at 8 K. The ice spectra were collected in the 113 to 183 nm range. We were able to estimate the UV-absorption cross section of the ice samples measuring the column density in situ with IR spectroscopy in transmittance.

Photoevaporation of protoplanetary disks by XUV stellar radiation.
Jorge Sanz-Forcada (CAB)

Planet formation as well as migration are impacted by disk photoevaporation via high-energy photons and viscous accretion. Cool stars are powerful XUV emitters during the early stages of their lives, while protoplanetary disks are forming. The high rotation rates of young late type stars yield strong magnetic fields in their corona, thus producing a high level of XUV (1–920 Å) radiation. The X-rays and EUV photons, impacting on protoplanetary disks drive photoevaporative winds which deplete disk gas at specific radii. Here we present several T Tauri stars with agess less than 15 Myr, for which we calculate the most complete XUV models to date. The expected disk photoevaporation from the XUV radiation is then used to interpret the actual infrared observations of the protoplanetary disks.

X-ray emission in star-forming regions.

Miguel Ángel López García (UCM)

Young stars, both massive and cool dwarfs are conspicuous X-ray emitters. High-velocity stellar winds in OB systems collide, increasing the temperature of the plasma (up to several MK), which emmit in X-rays. X-ray emission in cool dwarfs is produced by the presence of hot plasma with temperatures of up to 20 MK, trapped by strong magnetic fields. The intensity of the magnetic field decreases with rotation, which decreases with age. Therefore, X-ray emission is stronger at the first stages of the star's life. Dark molecular clouds are the nurseries of stars. Hence, star-forming regions are ideal laboratories to study X-ray emission processes. High-energy (UV and X-ray) emission interacts with the interstellar medium, evaporates circumstellar disks and, ultimately, influences the formation and evolution of stellar atmospheres. Our group is conducting a research on the physical processes that produce X-ray emission by stars and its influence in the medium.

Session 2: Abstracts

RRLs as a tool to study ionized outflows and disks around massive stars.

Alejandro Baez-Rubio (CAB)

Hydrogen radio-recombination lines (RRLs) are an excellent tool to unveil some of the processes of massive star formation since they are excellent proves of the ionized envelopes around this type of stars. In particular, RRLs have provided significant advances in the understanding of the kinematics of circumstellar disks around massive stars. We present the kinematics derived for one of the few very well established disks around a massive star: the Ultra-Compact H II region of MWC349A. This B[e] star stands out to be one of the best prototypes of massive star which excites a bipolar radio nebula expanding at nearly constant velocity. MWC349A has been for many years the only object known with maser emission at RRLs. By using a 3D non-Local Thermodynamic Equilibrium radiative transfer model, those maser lines have provided very detailed information about the kinematics and physical structure of the ionized gas. In particular the ionized disk seems to follow a pure Keplerian rotation and the kinematics seems to indicate that the ionized outflow is originated by the disk photo-evaporation. However, observations toward other massive stars are needed in order to know if those features are common to other dense UC-H II regions. In particular, the recent detection of RRL maser objects toward other the high-mass star forming regions, Cepheus A HW2 and MonR2-IRS2, open the possibility that maser RRLs maser become a key tool to study those features toward other massive stars and, thus, to make a step forward in the understanding of massive star formation.

Mining the sky for accreting T-Tauri stars outside star-forming region cores.

Alexis Klutsch (UCM)

We summarize our ongoing project aimed to characterize a sample of evolved (5 10 Myr) but still possibly accreting T Tauri stars (TTS) candidates discovered outside star-forming regions (SFR) cores or in sky regions mostly void of interstellar matter. For this end, we selected optical counterparts of RASS/XMM-Slew surveys X-ray sources cross-matched with 2MASS point sources over all the sky. These candidates were subsequently cross-correlated with the final release of the WISE all-sky survey catalog to search for stars with IR excess. Using sophisticated multivariate analysis methods developed for the automatic classification of XMM-Newton X-rays

sources we disentangle the stellar population from the extragalactic component (galaxies and quasars) also emitting in X-ray. WISE color-color and color-magnitude diagrams were then used to extract a subsample of TTS candidates with no reference in the literature or with only some basic data (i.e., magnitude, proper motions), but no additional important information indicating such nature. The IR excess was confirmed by their preliminary spectral energy distribution (SED) that we computed whenever possible. These SEDs allowed us to refine the selection so as keep only stars showing photospheric excess in the IR a priori compatible with circumstellar disks. Finally, we kept only candidates outside SFR cores (i.e., in surrounding regions several degrees apart from the cores) or in sky regions mostly void of interstellar matter. Intermediate-resolution optical spectra of the candidates selected in this way allowed us to confirm the nature of these objects. They would be of major importance to give new insight into the process of star formation in loose association or outside conventional SFR places.

What can YOU do in σ Orionis?.
Jose Antonio Caballero (CAB)

Although I may like a single-subject researcher for some of you, I will talk (again) on the young open cluster σ Orionis in the Ori OB1b association. But in this occasion, I will not speak on what I do there, but on what YOU can do: modelling chemistry in the Horsehead Nebula, determining precise masses of early-type stars, looking for inner gaps in circunstellar discs, finding X-ray brown dwarfs...

Planetary mass brown dwarfs in young clusters.
Catarina Alves de Oliveira (ESAC)

The observational properties derived for brown dwarfs in young clusters seem to show a global scaling down trend from those of stars, arguing in favour of a common formation scenario. However, up to date, most studies in young star forming regions suffer from incompleteness both at lower masses (below 40 Jupiter masses) and in the spatial content, frequently focusing on the inner regions of clusters. It is therefore unknown if, as one moves to lower masses, other formation mechanisms dominate. To address this question, we have carried out a large photometric and spectroscopic survey of nearby young clusters. I will present the results for the ρ Ophiuchi and IC348 clusters, where we have derived a complete census of the substellar population down to the planetary mass regime (few Jupiter masses), and studied the properties of this new population such as spatial distribution, disk fraction, and mass function.

The planetary-mass domain of the σ Orionis cluster.
María Rosa Zapatero Osorio (CAB) and collaborators

We will present the current status of our study of the free-floating planetary-mass population of the young (3 Myr), solar metallicity star cluster σ Orionis. Recently, we have collected near-infrared, low resolution spectra of six faint free-floating planet candidates with likely masses in the interval 6-13 M_{Jup} using ISAAC on the VLT. The data will be shown and analized to investigate the membership of the candidates in the cluster. The impact on the σ Orionis mass function will be also discussed.

On a full confirmation and characterization of Kepler planet candidates.

Jorge Lillo-Box (CAB)

The *Kepler* space telescope is currently providing the most outstanding sample of planetary candidates. To date, more than 2000 have been delivered to the scientific community and different efforts are taking place to confirm their nature. In this context, we are carrying a complete scheme of ground-based observations to fully confirm and characterize these planets. In a first step, we have observed more than 100 KOIs with high-resolution imaging by using the AstraLux instrument at the Calar Alto Observatory (Almeria, Spain). We concluded that around 40% of the candidates do present stellar companions (bounded or not) below the PSF size of the *Kepler* telescope, thus affecting the photometry and possibly mimicking a planetary transit. In a second step, we use low-resolution spectroscopy to fully characterize host star properties of those isolated KOIs as observed by AstraLux in previous step. Finally we are now analyzing our first dataset of high-resolution spectroscopy performed during the 2012 observing season with the new CAHA spectrograph (CAFE) to detect radial velocity variations and thus confirm and characterize the planet-star configuration. In this talk we will explain the results obtained up to date in our three steps as well as an update of the hard work which is being done to improve the CAFE radial velocity accuracy and all the new components recently included to that end.

Session 3: Abstracts

Star formation and disk evolution in the Coronet cluster: the history of a sparse cluster.

Aurora Sicilia-Aguilar (UAM)

The Coronet cluster is a young (1-2 Myr) star-forming region with a few intermediate-mass stars and a moderate low-mass population, concentrated in a cloud about 0.7 pc in radius. Despite its compactness, *Herschel*/PACS observations, together with ground-based spectroscopy and Spitzer data, reveal that the region contains objects in very different stages of evolution, from embedded protostars in the densest parts of the cloud to protoplanetary disks and diskless T Tauri stars. Among the protoplanetary disks, we find both primordial disks with strong accretion and objects with evident inside-out evolution. The Herschel observations of the protostellar population reveal a high degree of multiplicity and interactions among the protostellar population. We will explore whether these early interactions may be responsible for the evolutionary signs observed in the disks, which could explain the differences observed in disk fractions vs age among sparse and populous clusters and would suggest the importance of the environment and early history in the fate of the protoplanetary disks.

Herschel insight on circumstellar disc evolution: the GASPS project.

Pablo Rivière Marichalar (CAB/UAM)

The evolution of gas and dust in circumstellar environments is one of the main topics in present-day astrophysics, as planets are formed during the early stages of the circumstellar disc evolution. Later on, second generation debris discs can deeply influence the dynamics of planets in the system. Therefore, knowledge on the evolution of gas and dust in such environments is of main interest, as it will help us to understand how our own solar system was formed and how it evolved. Also, it can help us to distinguish between different models for planetary formation, and to understand the time scales implied.

The dust phase has been widely studied during the last 15 years, mainly thanks to the advance in submm and IR instrumentation. But the gas phase is not so well understood, due to the difficulties associated with the observational technics and to the lack of H_2 dipole emission in the radio regime, and therefore deserves more study.

The *Herschel* Space Observatory (HSO), with its unprecedented sensitivity and spatial resolution in the far-IR, has produced a valuable set of data in the field of circumstellar disc evolution that is ready for scientific exploitation. The GASPS (Gas Around Protoplanetary Systems) Project is a HSO Key Time Programme devoted to the study of gas and dust evolution in circumstellar environments. It makes use of the instrument PACS, aboard Herschel, to obtain 70, 100 and 160 m images and spectral line observations at 63.18 μm ([O I]) and 157.74 m ([C II]). During the talk, I plan to present the main results from the GASPS programme, focusing in some new results about the gas content in protoplanetary and debris discs, like the detection of water in 25% of gas rich discs in Taurus, or the detection of atomic oxygen emission in a debris disc.

Identification of transitional disks in Chamaeleon with Herschel.
Alvaro Ribas (CAB)

Transitional disks are circumstellar disks with inner holes, in some cases produced by planets and/or substellar companions in these systems. For this reason, they are extremely important for the study of the formation of planetary systems.

The *Herschel* Space Observatory provides an unique opportunity to study the outer regions of protoplanetary disks. In this work we update previous knowledge on the transitional disks in the Chamaeleon I and II regions with data from the *Herschel* Gould Belt Survey.

We propose a new method for transitional disk classification based on the the WISE 12 microns - PACS 70 microns color, together with inspection of the *Herschel* images. We apply this method to the population of Class II sources in the Chamaeleon region, and study the spectral energy distributions of the transitional disks in the sample. We also build the median spectral energy distribution of Class II objects in these regions for comparison with transitional disks.

The proposed method allows a clear separation of the known transitional disks from the Class II sources. We find six transitional disks, all previously known, and identify five objects previously thought to be transitional as possibly non-transitional. We find larger fluxes at the PACS wavelengths in the sample of transitional disks with respect to that of Class II objects.

We show the *Herschel* 70 microns band to be a robust and efficient tool for transitional disk identification. The sensitivity and spatial resolution of *Herschel* reveal a significant contamination level among the previously identified transitional disk candidates for the two regions, calling for a revision of previous samples of transitional disks in other regions. The systematic excess found at the PACS bands could be either a result of the mechanism producing the transitional phase, or an indication of different evolutionary paths for transitional disks and Class II sources.

DUst around NEarby Stars (DUNES): description of the project and results.
Benjamin Montesinos (CAB), Carlos Eiroa (UAM) and the DUNES team

The *Herschel* Open Time Key Project DUNES aims at detecting faint debris discs around nearby solar-type stars with fractional luminosities similar to that of the Edgeworth-Kuiper belt (EKB), putting in this way the Solar System into context. The DUNES sample is composed of 133 FGK main-sequence stars in the solar neighbourhood that has been already observed by PACS in

100 and 160 micron, complemented with observations in 70 micron for some objects and also at longer wavelengths with SPIRE. The survey addresses some specific questions related to the prevalence and properties of planetesimals systems around main-sequence stars. In this talk we will describe the project and outline the main results obtained so far.

A comprehensive X-Shooter survey of nearby star forming regions.
Beate Stelzer (Palermo), J. M. Alcalá, Italian star formation X-Shooter/GTO team

I present a brief summary of the ongoing activities from an extensive X-Shooter/VLT survey of nearby star forming regions carried out within the Italian GTO. Roughly 60 low-mass pre-main sequence stars and brown dwarfs in Lupus, σ Ori and TW Hya have been observed with broad-band ($350 - 2500$ nm) medium-resolution spectroscopy.

This survey allows a detailed characterization of the young stellar objects, including an accurate assessment of fundamental parameters, kinematics, rotation, and magnetic activity. In particular, it provides a rich database of accretion diagnostics from the Brγ and Paβ lines in the near-IR to the Balmer jump in the UV (detected even in some brown dwarfs), including the full optical band with the Balmer series and He λ5876 and the Ca IRT. Several of our targets drive outflows that are traced by forbidden lines.

The enormous wavelength range of X-Shooter together with its high sensitivity and good spectral resolution yields the unique opportunity for comparing all diagnostics for studies of accretion and outflows in young stellar objects and thus test their validity.

Discovery of Brown Dwarfs and Subdwarfs using VO.
Miriam Aberasturi (CAB)

The increased number of known brown dwarfs (BDs) and ultracool subdwarfs (sdMs) has been accompanied by the development of infrared large surveys, like SDSS, 2MASS, UKIDSS and more recently, WISE. The handling of so much information is only possible using the Virtual Observatory (VO) which offers to the astronomical community an easy data access and analysis in the exploration of the information that resides in the data archives. In order to discovery and characterize new BDs and sdMs, we have made use the VO tools (Aladin, Topcat and VOSA) to perform a cross-macht between SDSS/UKIDSS and SDSS/2MASS/WISE, respectively. The VO methodology and results will be presented in the Workshop.

Searching for common proper-motion companions in the Local Association and its young kinematic subgroups.
Francisco Javier Alonso-Floriano (UCM), José Antonio Caballero (CAB), David Montes (UCM)

We describe the results of an ongoing project aimed to identify new members of young associations by searching for common proper-motion companions to already-known members. We have used the Aladin sky atlas of the VO and the 2MASS, USNO-B1 and PPMXL astro-photometric catalogues to look for new faint members in the the LocalAssociation and its young kinematic groups (Tucana-Horologium, β Pic, AB Dor). We have discovered several new late-type stellar companions. For one of the new identified objects, we have taken low-resolution spectroscopy to confirm its young nature and characterise its stellar properties. A detailed study of Tucana-Horologium has provided an unprecedented view of the moving group nucleus around $\beta^{01+02+03}$ Tuc, which lies at the centre of the remnant of the cluster that originated the group.

High precision astrometry from the ground: complementing Gaia.
Hervé Bouy (CAB)

We present a new set of tools designed to process large sets of wide field images originating from any observatory, and combine them to derive precise proper motion. The estimated accuracy reaches 0.3mas/yr depending on the observational history and luminosity. These proper motion measurements are used to select members of young associations and clusters, refine the luminosity functions, and study the internal dynamics of the cluster, providing important feedback and inputs for the models and numerical simulation of star formation.

The JWST Mid-IR Instrument (MIRI). A future new window into the star/planet formation processes.
Luis Colina (CAB)

MIRI, the mid-IR instrument for the James Webb Space Telescope was delivered to NASA last May. MIRI has been developed by a consortium of european institutes under the leadership of UK-ATC (Gillian Wright, PI) and with the participation of ESA and institutions in the USA. This presentation will review the general characteristics of MIRI and the specific operational modes adequate for the study of the formation of stars and characterization of exoplanets.
