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Authors Leonardo Testi (ESO)

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1.2 Content

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2 Report

The conference was co-organized and co-sponsored by all the ALMA partners, with an important additional contribution from the European Commission FP7 RadioNet3 project. 189 astronomers from all over the world gathered in the beautiful setting of the town of Puerto Varas in southern Chile to discuss ALMA science (see Figure 1). Senior astronomers and many young students and postdocs shared their enthusiasm over the first ALMA results. Thijs de Graauw, Massimo Tarengi and Pierre Cox, current, previous and future ALMA Directors respectively, addressed the participants, sharing with them their insights and reflections on the initial phases of construction, the excitement of delivering the first science observations and the great expectations for the future science results. Two public evenings were also organized as part of the conference events, with Raphael Bachiller (Director of the Observatorio Astronómico Nacional [OAN] in Madrid, ESO Council Member and Chairman of the RadioNet3 Board) and Juan Cortes of the Joint ALMA Observatory (JAO) presenting the ALMA project and its science objectives to the general public.

The promise of ALMA was to revolutionize many scientific areas by providing an unprecedented quantity and quality of high spatial and spectral resolution (sub)millimetre wavelength spectral line data. The ALMA challenge is then to allow observers to perform detailed tests of astrochemical models, star and planet formation, galaxy formation and evolution, and many other investigations. Throughout the conference, the transformational power of ALMA data, even with the limited capabilities available so far during SV and Cycle 0, were emphasized many times. The enormous progress in sensitivity and image fidelity provided by ALMA, even at these early stages, was clearly demonstrated.

The science programme of the conference included eight overview talks introducing the different areas of ALMA Science, 43 oral contributions, all presenting results from ALMA data, and approximately 100 posters on observational, theoretical and instrumental topics connected with ALMA. A short summary of the main science highlights is provided below.

Links

The scientific presentation and the posters are available online at the webpages:

<http://www.almasc.org/2012/index.php/program>

<http://www.almasc.org/2012/index.php/poster-information>

Some of the presented scientific discoveries are new and of a high impact, therefore they are at present in the publications stage by ranked journals such Nature etc. As a consequence, the authors of those presentations (also posters) did not make them publicly available for this report and they are not open for download.

2.1 Scientific report

Astrochemistry

Astrochemistry was one of the main recurring topics in the conference, across all the science areas. The ALMA sensitivity has transformed the field of astrochemistry from being confined to exotic Galactic sources and a few starburst galaxies to a theme that encompasses all areas of ALMA science. Different chemical evolutionary paths during the formation of protostars were discussed at the conference: the new ALMA data are highlighting not only the distinction between “hot corino” and “warm carbon chain chemistry” protostars, which need to be understood and reconciled in a common framework, but also the chemical complexity of the interplay between dust, ices and different molecular species and isotopologues in the path from clouds to planetary systems.

The chemistry of deuterated and complex organic molecules in protostars and discs was a major discussion topic, with talks and posters showing the mapping of water isotopes and deuterated species in the planet forming regions of discs. In a young solar analogue a simple sugar, glycoladeheyde, has been detected (see Testi et al. 2012 and ESO Release 1234), which is thought to be an essential step in developing biotic molecules, in particular the RNA molecule. The impact of astrochemistry on extragalactic studies was also highlighted by the Cycle 0 observations of nearby and high redshift galaxies, which at the ALMA sensitivity are now showing emission from many of the complex and less abundant molecules that have, so far, been mostly studied in our own Galactic environment.

Solar System science

The power of ALMA to study and understand the atmospheres and surfaces of bodies in our own Solar System was reviewed. Some of the main topics where ALMA is expected to make a contribution are in the characterization of the chemical composition and seasonal variation of the atmospheres of planets and moons, and preliminary ALMA maps of Venus and Titan illustrated this point. A detailed analysis of a combined Herschel-ALMA study of the great storm in Saturn's atmosphere was also presented. The analysis of the data from the two observatories confirms that, while the differing CO intensity inside and outside of the storm is just caused by a higher temperature within the storm and not by an abundance variation, the H₂O abundance in the storm is higher than in the rest of the stratosphere of the planet and was probably caused by the vapourization of icy clouds and enrichment with material from the O-rich troposphere. Much progress is expected to come from the study of the chemical composition of comets, which should provide important constraints on the origin of water and, possibly, complex organic molecules on Earth.

Star formation

Besides the chemical studies, ALMA is now providing new insights on the physical and kinematical structure of protostars and young stellar objects. The first hints that ALMA has started to address directly the long-standing problem of the kinematical signature of disc formation during protostellar collapse was presented at the meeting. Detailed analysis of the CO isotopes in the so-called Class 0 protostars reveals a possible break in the kinematics of the collapsing envelope within the central 30-40 AU, an indication of a small inner disc in Keplerian rotation around the central protostar.

The quest for the initial conditions for high mass star formation has already been brought to a new level with ALMA, where detailed studies of different candidates across the Galaxy provide critical data that can now be directly compared with numerical models. The role of discs and outflows and their structure in the formation of highest mass stars was also addressed. Tantalizing new evidence for Keplerian discs surrounding very massive protostellar candidates provides direct constraints on the formation mechanism (see Figure 2 for an example). The high angular resolution, sensitivity and wide area interferometric mapping capabilities of ALMA are also proving to be a key tool to understand the formation of very massive clusters, both in our Galaxy and in the Local Universe. The spectacular images of a proto young massive cluster candidate near the Galactic Centre reveal for the first time a chemical, physical and kinematical complexity that will keep both observers and theorists occupied for several years.

Planet formation

Several new ALMA Cycle 0 results were presented on the structure and evolution of protoplanetary discs and the implications for the formation of planetary systems. Observations of dust evolution in discs around very low mass stars and brown dwarfs with ALMA cannot easily be explained with the existing dust evolution models, suggesting that our understanding of the processes governing dust evolution in discs is not complete (see Release eso1248). The detection of CO in several of these discs around young brown dwarfs confirms that some of these are indeed surrounded by relatively large and massive discs.

Already in Cycle 0, ALMA has started to transform the field of planet formation. The sensitivity of ALMA in the high frequency bands, as compared to the previous facilities, has allowed high quality images to be obtained of the asymmetries in the dust distribution and quantitative measurement of the gas content in the inner dust-evacuated holes of evolved discs. The data reveal indirectly the presence of forming planets and constrain the flow of material from the outer disc through the planet and into the inner regions of the system (see Figure 3 and Release eso1301). The dust asymmetries are interpreted as the effect of a planet that induces an asymmetric pressure variation in the outer disc creating an efficient trap for dust grains. The ALMA sensitivity and angular resolution also allows the direct detection of the CO emitting layer in the large disc around HD163296 and to directly constrain the flaring of the disc in molecular gas.

Stellar evolution

ALMA can also provide new constraints not only on the cool side of the Universe, but also on the hot atmospheres of stars. Multi-wavelength observations at centimetre and millimetre wavelengths of the stellar chromospheres can allow the amount of magnetic heating in stars to be probed. For this reason, the capability of observing the Sun is one of the key features of ALMA, and has been designed into the system from the very beginning of the project. While observations of the Sun are still being tested and commissioned, ALMA has been observing different phases of stellar evolution from the beginning of Cycle 0. Millimetre flares in young stellar objects have been recently observed and will become an important topic for ALMA science owing to the high sensitivity available.

Millimetre continuum observations will also be critical to separate the non-thermal emission from the coronae and the stellar wind component, allowing direct measurements of the mass loss in stars of various masses and ages. Initial results in this area are expected from Cycle 1 programmes. In Cycle 0, several programmes focused on the study of the mass loss in the late stages of evolved stars. Observations of stars in the late stages of stellar evolution provide constraints on the chemical enrichment of the interstellar medium. Some of the most spectacular ALMA data on the late stages of stellar evolution presented at the meeting

included: the mass loss history following the thermal pulse in the AGB star RScI (see ESO release eso1239 and the cover of Messenger 149) and detection of the dust, CO and SiO emission in the ejecta of SN1987A in the Large Magellanic Cloud.

Galaxy formation

In the nearby Universe there is the potential to directly study with ALMA the sites of star formation, i.e. giant molecular clouds (GMCs), in order to derive the star formation efficiency and the gas depletion time on sub-galactic scales. These can be related to galaxy properties, such as metallicity, cloud densities and pressures and velocity dispersions. Some nearby galaxies have already been targets of ALMA SV projects. The impressive M100 large-scale mosaic shows that CO emission traces a two-armed spiral and a double bar out to 10 kpc and that the time needed for the current star formation rate to consume the existing gas reservoir is 1.7-1.9 Gyr.

Molecular gas fragmentation has been observed to occur at pc scales along filamentary structures in NGC 253, the Antennae galaxy and 30 Doradus. At galactic scales, the parents of these filamentary structures are GMCs, with masses of $\sim 10^{5-6} M_{\text{sun}}$ and sizes of tens of pc. These are found in spiral galaxies and in the interarm region of the overlap of the arms of the Antennae. A newly discovered tidal filamentary arm was presented in NGC 4039, 3.4 kpc long and <200 pc wide, where the star formation efficiency is a factor of ten larger than in disc galaxies.

ALMA's resolution also enables details of the centres of nearby mergers to be probed. Double nuclei have been detected in NGC 3256, similar to those in Arp 220, while in NGC 34 (a luminous infrared galaxy with an AGN) Band 9 CO(6-5) observations are consistent with two nuclei: one associated with a starburst and another with the AGN.

Several presentations clearly pointed out the fundamental contribution that ALMA is providing in the field of galaxy formation in addressing the major mechanisms: merger and starburst driven or governed by secular evolution. An initial attempt to answer some specific questions was carried out by the LESS and COSMOS continuum surveys with the determination of galaxy counts. These surveys also enable better estimation of the spectral energy distribution (SED) of galaxies, and therefore of the dust mass and gas fraction.

Active galactic nuclei

One of the biggest puzzles in active galactic nuclei (AGN) physics is the removal of the angular momentum from the disc gas and mechanisms driving infall down to the

nucleus on scales of tens of parsecs. Simulations suggest a role of galaxy bars but no correlation between AGN activity and bars is seen. New ALMA results for two sources (NGC 1433 and NGC 1566) show that the dense molecular gas seems to fuel into the nucleus at the unprecedented spatial resolution of 24 pc. The kinematics of the nuclear spiral arms in NGC 1097 have been followed down to ~ 50 pc from the central supermassive black hole (SMBH) from the ALMA detection of HCN, a tracer of high density gas.

Absorption lines in the spectra of AGN, of the nearby Centaurus-A (Cen-A) and of PKS1830-211 at $z = 0.886$, were also shown. Such investigations offer a unique opportunity to find gas that might be feeding the AGN. Towards the SMBH of Cen-A, the gas becomes denser, warmer and influenced by the presence of photon dissociation regions (PDRs). Detailed study of absorption lines towards AGN reveals the chemical enrichment of the Universe through isotopic ratios and can constrain the constancy of fundamental constants by detecting line shifts with respect to laboratory measurements, such as in PKS1830-211, where ALMA observations include water in absorption.

Molecular outflows may be associated with AGN activity or with vigorous starbursts and have been detected with ALMA in $\text{HCO}^+(4-3)$ and $\text{CO}(3-2)$ through their high velocity wings. In the centre of NGC 253, the ALMA detection of the $\text{H40}\alpha$ line in a molecular outflow raises the question of the mechanism for efficient transfer of angular momentum to the molecular gas. Several talks pointed out the need to measure outflow rates of cold gas and test star formation and AGN feedback models. A key issue is the investigation of the processes that quench star formation and turn galaxies into “red and dead”. New ALMA results were presented on a sample of extremely rare ultra/hyper-luminous very red radio-loud quasars, which are considered young jet feedback candidates at $z = 0.5 - 3$. ALMA is able to put strong constraints on the presence of cool dust and star formation, and to confirm that this sample consists of heavily obscured Type 2 quasars, often Compton thick and very strongly AGN-dominated; some sources do not show any evidence of star formation.

The environment around galaxies, such as the X-ray cavities in galaxy clusters provides good locations for measuring the mechanical power injected by the SMBH. AGN heating is energetically sufficient to offset radiative cooling in galaxy cluster cores and can be coupled to the cooling gas and therefore to feedback. CO has been detected in the centre of two nearby clusters with extreme X-ray cooling rates; a radiative cooling time < 1 Gyr and a SFR of $10\text{--}100 M_{\text{sun}}/\text{yr}$ of the central radio galaxy were derived. The bulk of the cold gas is centrally condensed and has a similar spatial extent to the star formation.

Observations of two extremely obscured luminous infrared galaxies (LIRGs) with very large obscuration and hidden compact IR cores show a rich, hot-core-like chemistry with vibrationally excited HC_3N , HNC and HCN . In NGC 1266, an interacting galaxy, we are witnessing a rapid cessation of star formation, with a dense molecular gas outflow rate of $\sim 100 M_{\text{sun}}/\text{yr}$, much larger than the star formation rate. An AGN is the likely driver of the outflow, and shocked molecular gas is located near the launch point of the outflow, as seen in ALMA multi-transition SiO observations. The detection of other molecular species with ALMA will help build a more complete chemical picture of NGC 1266.

High redshift sources

The redshifts of very high- z ($z > 5$) galaxies leads to fuller understanding of the objects responsible for the reionization of the Universe. Their redshifts can be determined through detection of the $[\text{C II}]$ line, which is the principal ISM gas coolant, traces PDRs, and warm intergalactic and circumnuclear media (see Figure 4 for an example). $[\text{C II}]$ is up to ten times more luminous than any other line in the far infrared / millimetre range and at $z > 5$ the line is redshifted into ALMA bands. ALMA can detect $[\text{C II}]$ from a galaxy with a star formation rate of only $5 M_{\text{sun}}/\text{yr}$ at $z=7$ in 1 hour (5σ in 2 channels). Furthermore, in low metallicity systems, as high- z objects are expected to be, the ratio $[\text{C II}]/\text{FIR}$ is larger, i.e. increases with decreasing metallicity (see Nagao et al. 2012). Outflows can also be detected in such distant galaxies, as revealed by $[\text{C II}]$ emission line profiles in a $z = 6.4$ quasar with velocities > 1000 km/s, size $> 10\text{kpc}$ and an outflow mass rate of $\sim 3000 M_{\text{sun}}/\text{yr}$. The gas consumption timescale due to outflow may be less than the star formation timescale, highlighting the “quasar-mode” feedback process which inhibits further star formation and enriches the local intergalactic medium.

Gravitational lenses

The flux magnification provided by gravitational lensing enabled a spectroscopic redshift survey with ALMA to be performed in Cycle 0, targeting 26 sources from the South Pole Telescope using CO line detections (see Figure 4). 40% of these sources lie at $z > 4$. It

appears that the fraction of dusty starburst galaxies at high-redshift is far higher than previously thought. Two sources were found at $z = 5.7$, placing them among the highest redshift starbursts known, and demonstrating that large reservoirs of molecular gas and dust can be present in massive galaxies near the end of the epoch of cosmic reionization. The ALMA detection of the arcs and source images of a beautiful gravitational lens, g15.v2.19, was also shown and discussed.

Prize poster competition

Given the large participation of young students and postdocs, who presented many excellent results in the poster sessions, the Scientific Organizing Committee decided to organize a competition for the best posters amongst them. The poster prize committee, composed of the overview speakers and the project scientists, awarded three prizes for the best science posters to: E. Akiyama for the analysis of the SV data on the protoplanetary disc around the intermediate-mass pre-main sequence star HD163296; R. Herrera-Camus, for the important work on the calibration of the [C II] line as a star formation tracer in the deep Universe; and M. McCoy for the study on the Early Science absorption spectrum of the nearby active galactic nucleus of Cen-A. Each of the three winners received an ALMA coffee mug, as a useful tool for the long hours to be spent on the scientific interpretation of the ALMA data, and a copy of the book “Cerca del cielo”, to remind them of the beauty and biological richness of the region in northern Chile that hosts the ALMA Observatory. Two posters describing important technical developments for ALMA also received a special mention: A. Avison for his work on the Observation Support Tool and H. Nagai for the description of the status of ALMA polarization observations.

The practical organization of the meeting was a great success, thanks to the efforts of the local organizing committee at JAO: Mariluz Calderón, Ann Edmunds, Valeria Foncea, Itziar de Gregorio Monsalvo, Violette Impellizeri, Hanifa Nalubowa, and Gautier Mathys (chair).

2.2 Participant list

	Name	Institute	Country
1.	ADAMS, Mark	National Radio Astronomy Observatory	USA
2.	AKIYAMA, Eiji	National Astronomical Observatory of Japan	Japan
3.	ALADRO, Rebeca	ESO	Chile
4.	ALATALO, Katherine	California Institute of Technology/IPAC	USA
5.	AMIGO, Pía	University of Valparaíso	Chile
6.	ANDREANI, Paola	ESO	Germany
7.	ANGELONI, Rodolfo	P. Universidad Católica de Chile	Chile
8.	ARAUDO, Anabella	Universidad Nacional Autónoma de México	México
9.	ARAVENA, Manuel	ESO	Chile
10.	ARCE, Hector	Yale University	USA
11.	AVISON, Adam	Jodrell Bank Centre for Astrophysics, University of Manchester	United Kingdom

	Name	Institute	Country
12.	BACHILLER, Rafael	Observatorio Astronómico Nacional	Spain
13.	BALL, Lewis	ALMA	
14.	BARCOS-MUÑOZ, Loreto	University of Virginia	USA
15.	BARRIENTOS, Felipe	P. Universidad Católica de Chile	Chile
16.	BARSONY, Mary	SETI Institute	USA
17.	BOLATTO, Alberto	University of Maryland	USA
18.	BONILLA, Alexander	University of Valparaiso	Chile
19.	BRADAC, Marusa	UC Davis	USA
20.	BREEN, Shari	CSIRO Astronomy and Space Science	Australia
21.	BRESSERT, Eli	CSIRO Astronomy and Space Science	Australia
22.	BROGAN, Crystal	National Radio Astronomy Observatory	USA
23.	BRONFMAN, Leonardo	Universidad de Chile	Chile
24.	CACERES, Claudio	University of Valparaiso	Chile
25.	CALES, Sabrina	Universidad de Concepcion	Chile
26.	CARILLI, Chris	National Radio Astronomy Observatory	USA
27.	CASASOLA, Viviana	INAF - IRA Bolgna & Italian ARC	Italy
28.	CAVALIÉ, Thibault	Laboratoire d'Astrophysique de Bordeaux	France
29.	CHAPILLON, Edwige	Academia Sinica, Institute of Astronomy & Astrophysics	Taiwan
30.	CHINI, Rolf	Instituto de Astronomia U.Catolica del Norte	Chile
31.	CHUNG, Eun Jung	Sejong University	Republic of Korea
32.	CONTRERAS, Yanett	CSIRO Astronomy and Space Science	Australia
33.	CORDER, Stuartt	ALMA	Chile
34.	COSTAGLIOLA, Francesco	Chalmers University of Technology	Sweden
35.	COX, Pierre Henri	IRAM - Institut de RadioAstronomie Millimétrique	France
36.	DE OLIVEIRA ALVES, Felipe	Argelander-Institut für Astronomie	Germany
37.	DeGRAAUW, Thijs	ALMA	Chile
38.	DeGREGORIO-MONSALVO, Itziar	ALMA	Chile
39.	DOUGADOS, Catherine	Universidad de Chile	Chile
40.	DUNHAM, Michael	Yale University	USA
41.	ESCALA, Andres	Universidad de Chile	Chile
42.	ESPADA, Daniel	National Astronomical Observatory of Japan	Japan
43.	EVANS, Neal	University of Texas at Austin	USA
44.	FARIHI, Jay	University of Cambridge	United Kingdom
45.	FERKINHOFF, Carl	Cornell University	USA
46.	FOËX, Gaël	University of Valparaiso	Chile

	Name	Institute	Country
47.	FONSEA, Valeria	ALMA	Chile
48.	FRANCO-HERNANDEZ, Ramiro	Universidad de Chile	Chile
49.	FUKAGAWA, Misato	Osaka University	Japan
50.	FULLER, Gary	University of Manchester	United Kingdom
51.	GALAZ, Gaspar	P. Universidad Católica de Chile	Chile
52.	GALLEGO, Sofia	P. Universidad Católica de Chile	Chile
53.	GALLERANI, Simona	Scuola Normale Superiore di Pisa	Italy
54.	GARAY, Guido	Universidad de Chile	Chile
55.	GARCIA-APPADOO, Diego	ALMA	Chile
56.	GODDI, Ciriaco	ESO/JIVE	Netherlands
57.	HAISCH, Karl	Utah Valley University	USA
58.	HALES, Antonio	ALMA	Chile
59.	HAND, Eric	Nature magazine	USA
60.	HARDY, Eduardo	Associated Universities Inc	Chile
61.	HERRERA-CAMUS, Rodrigo	University of Maryland	USA
62.	HESSER, Jim	National Science Infrastructure	BC
63.	HIBBARD, John	National Radio Astronomy Observatory	USA
64.	HIGUCHI, Aya	ALMA	Chile
65.	HIRAMATSU, Masaaki	National Astronomical Observatory of Japan	Japan
66.	HIRANO, Naomi	Academia Sinica, Institute of Astronomy & Astrophysics	Taiwan
67.	HIROTA, Tomoya	National Astronomical Observatory of Japan	Japan
68.	HOGERHEIJDE, Michiel	Leiden Observatory	Netherlands
69.	HUELAMO, Nuria	CAB	Spain
70.	HUNTER, Todd	National Radio Astronomy Observatory	USA
71.	IBAR, Edo	P. Universidad Católica de Chile	Chile
72.	IMPELLIZZERI, Violette	ALMA	Chile
73.	INDEBETOUW, Remy	National Radio Astronomy Observatory	USA
74.	IONO, Daisuke	National Astronomical Observatory of Japan	Japan
75.	ISHII, Shun	University of Tsukuba	Japan
76.	JEWELL, Phil	National Radio Astronomy Observatory	USA
77.	JOHNSON, Kelsey	University of Virginia	USA
78.	JOHNSTONE, Doug	NRC Canada	Canada
79.	JORGENSEN, Jes	University of Copenhagen	Denmark
80.	KAMENETZKY, Julia	University of Colorado	USA
81.	KAWABE, Ryohei	ALMA	Chile
82.	KEATING, Marylin	ALMA	

	Name	Institute	Country
83.	KIM, Sam	P. Universidad Católica de Chile	Chile
84.	KIM, Sungeun	Sejong University	South Korea
85.	KIYOKANE, Kazuhiro	The University of TOKYO, JAPAN	Japan
86.	KOCH, Patrick	Academia Sinica	Taiwan
87.	KOHNO, Kotaro	University of Tokyo	Japan
88.	KOMUGI, Shinya	ALMA	Chile
89.	KURONO, Yasutaka	National Astronomical Observatory of Japan	Japan
90.	LACKINGTON, Matias	University of Manchester	United Kingdom
91.	LAI, Shih-Ping	National Tsing Hua University, Taiwan	Taiwan
92.	LAING, Robert	ESO	Germany
93.	LOISEAU, Nora	XMM-Newton, ESAC	Spain
94.	LONSDALE, Carol	National Radio Astronomy Observatory	USA
95.	LÜDKE, Everton	Universidade Federal de Santa Maria	Brazil
96.	LUNDGREN, Andreas	ALMA	Chile
97.	MAERCKER, Matthias	ESO/Alfa	Germany
98.	MAGALHAES, Antonio	IAG - Univ. Sao Paulo	Brazil
99.	MARCAIDE, Jon	Universidad de Valencia	Spain
100.	MARCELINO, Nuria	National Radio Astronomy Observatory	USA
101.	MARDONES, Diego	Universidad de Chile	Chile
102.	MARTIN, Sergio	ESO	Chile
103.	MATHYS, Gautier	ALMA	Chile
104.	MATSUZAWA, Ayumu	Graduate University of Advanced Studies/NAOJ	Japan
105.	McCOY, Mark	New Mexico Tech	USA
106.	MELNICK, Jorge	ESO	Chile
107.	MENARD, Francois	Laboratoire Franco-Chilien d'Astronomie, Chile & IPAG, Grenoble	Chile
108.	MERELLO, Manuel	University of Texas at Austin	USA
109.	MESSIAS, Hugo	Universidad de Concepcion	Chile
110.	MIGNANO, Arturo	IRA - INAF	Italy
111.	MIYAMOTO, Yusuke	University of Tsukuba	Japan
112.	MOLLÁ, Mercedes	CIEMAT	Spain
113.	MOMOSE, Munetake	Ibaraki University	Japan
114.	MOÓR, Attila	Konkoly Observatory	Hungary
115.	MORENO, Raphael	Observatoire de Paris	France
116.	MULLER, Sebastien	Onsala Space Observatory	Sweden
117.	MUÑOZ, Alejandra	P. Universidad Católica de Chile	Chile

	Name	Institute	Country
118.	MURILLO, Nadia	National Tsing Hua University	Taiwan
119.	MURPHY, David	P. Universidad Católica de Chile	Chile
120.	MUTO, Takayuki	Kogakuin University	Japan
121.	MUXLOW, Tom	UK ALMA Regional Centre	United Kingdom
122.	NAGAI, Hiroshi	National Astronomical Observatory of Japan	Japan
123.	NAGAO, Tohru	Kyoto University	Japan
124.	NAKOS, Theodoros	ALMA	Chile
125.	NYMAN, Lars-Ake	ALMA	Chile
126.	OHASHI, Nagayoshi	National Astronomical Observatory of Japan	Hawaii
127.	ONISHI, Kyoko	The Graduate University for Advanced Studies	Tokyo
128.	ONISHI, Toshikazu	Osaka Prefecture University	Japan
129.	OSTEN, Rachel	Space Telescope Science Institute	USA
130.	OTT, Juergen	National Radio Astronomy Observatory	USA
131.	PADGETT, Deborah	NASA/Goddard Space Flight Center	USA
132.	PALADINO, Rosita	IRA - Italian ALMA regional center	Italy
133.	PECK, Alison	National Radio Astronomy Observatory	USA
134.	PERETTO, Nicolas	CEA Saclay	France
135.	PEREZ, Laura	National Radio Astronomy Observatory	USA
136.	PEREZ, Sebastian	Universidad de Chile	Chile
137.	PHILLIPS, Neil	ALMA	Chile
138.	PINEDA, Jaime	ESO and University of Manchester	United Kingdom
139.	PLUNKETT, Adele	Yale University, Universidad de Chile	Chile
140.	RATHBORNE, Jill	CSIRO Astronomy and Space Science	Australia
141.	RAWLINGS, Mark	National Radio Astronomy Observatory	USA
142.	RIBEIRO, Nadili	IAG - USP	Brazil
143.	RICCI, Luca	California Institute of Technology	USA
144.	RICHARDS, Anita	UK ARC Node, University of Manchester	United Kingdom
145.	RODON, Javier	ESO	Chile
146.	RUBIO, Monica	Universidad de Chile	Chile
147.	RUSHTON, Anthony	ESO	Germany
148.	RUSSELL, Helen	University of Waterloo	Canada
149.	SAIGO, Kazuya	National Astronomical Observatory of Japan	Japan
150.	SAITO, Toshiki	University of Tokyo	Japan
151.	SAJINA, Anna	Tufts University	USA
152.	SAKAMOTO, Kazushi	ASIA	Taiwan

	Name	Institute	Country
153.	SALGADO, Francisco	Leiden Observatory	Netherlands
154.	SALTER, Demerese	P. Universidad Católica de Chile	Chile
155.	SALYK, Colette	National Optical Astronomy Observatory	USA
156.	SCOTT, Kimberly	National Radio Astronomy Observatory	USA
157.	SERVAJEAN, Elise	Universidad de Chile	Chile
158.	SHEEN, Yun-Kyeong	Universidad de Concepcion	Chile
159.	SHETH, Kartik	National Radio Astronomy Observatory	USA
160.	SILVA BUSTAMANTE, Andrea	Trufts University	USA
161.	SOLIS, Basilio	Planetarium of University of Santiago	Chile
162.	STAPELFELDT, Karl	NASA/Goddard Space Flight Center	USA
163.	STEFL, Stanislav	ALMA	Chile
164.	TACCONI, Linda	MPE Garching	Germany
165.	TACHIHARA, Kengo	ALMA	Chile
166.	TAN, Jonathan	University of Florida	USA
167.	TANG, Ya-Wen	Institute of Astronomy and Astrophysics, Academia Sinica, Taiwan	Taiwan
168.	TARENGHI, Massimo	ESO	Chile
169.	TATEMATSU, Ken'ichi	National Astronomical Observatory of Japan	Japan
170.	TESTI, Leonardo		
171.	TREISTER, Ezequiel	Universidad de Concepcion	Chile
172.	UEDA, Junko	University of Tokyo/NAOJ	Japan
173.	van der MAREL, Nienke	Leiden Observatory	Netherlands
174.	Van der Plas, Gerrit	Universidad de Chile	Chile
175.	Van DISHOECK, Ewine	Leiden Observatory / MPE	Netherlands
176.	VanKEMPEN, Tim	Leiden Observatory / Joint ALMA Offices	Netherlands
177.	VIEIRA, Joaquin	California Institute of Technology	USA
178.	VILA, Baltasar	ALMA	Chile
179.	VILLARD, Eric	ALMA	Chile
180.	VLAHAKIS, Catherine	ALMA	Chile
181.	VORONKOV, Maxim	CSIRO Astronomy and Space Science	Australia
182.	WAELEKENS, Christoffel	Institute for Astronomy KULeuven	Belgium
183.	WAGG, Jeff	ESO/Cavendish Labs	
184.	WILSON, Christine	McMaster University	Canada
185.	WOOTEN, Al	National Radio Astronomy Observatory	USA
186.	XU, Kevin	California Institute of Technology	USA
187.	YAN, Lin	California Institute of Technology	USA
188.	ZAPATA, Luis	CRyA-UNAM	Mexico
189.	ZINNECKER, Hans	Deutsches SOFIA Institut, NASA Ames Res. Center	USA

2.3 Meeting programme

<http://www.almasc.org/index.php/program>

Tuesday, December 11, 2012

15:30 - 17:30 Registration
18:30 - 20:00 Welcome cocktail

Wednesday, December 12, 2012

08:00 - 09:00 Registration
09:00 - 09:10 Welcome and foreword by ALMA Director - Thijs de Graauw
09:10 - 09:25 Opening address - Gabriel Rodriguez, Ministerio de Relaciones Exteriores, Chile
09:25 - 09:30 Logistic information
09:30 - 09:35 *Introduction* - Leonardo Testi
09:35 - 10:05 *Science with ALMA: from dream to reality* - Stuart Corder

Session 1 : Galaxies Evolution

10:05 - 10:50 *Galaxies Evolution* - Overview Linda Tacconi
10:50 - 11:20 **Break**
11:20 - 11:40 *Reformation of cold molecular gas disks in merger remnants* - Junko Ueda
11:40 - 12:00 *ALMA exploration of warm molecular gas in nearby LIRGs* - Kevin Xu
12:00 - 12:20 *Molecular gas and AGN feedback in galaxy cluster cores* - Helen Russell
12:20 - 14:00 **Lunch Break**
14:00 - 14:20 *Hot Potatoes: Compact obscured nuclei with ALMA* - Francesco Costagliola
14:20 - 14:40 *Feeding and feedback in the nearby Seyfert 2 NGC 1433* - Viviana Casasola
14:40 - 15:00 *Mapping shock chemistry in NGC 1266: Local example of AGN-driven feedback* - Katherine Alatalo
15:00 - 15:20 *A survey of strong absorption lines at $z=0.89$ towards PKS1830-211* - Sebastien Muller
15:20 - 16:20 **Coffee+Poster viewing**

Session 2 : ISM and star formation

16:20 - 17:05 *High mass star formation throughout the Galaxy, Overview* - Guido Garay
17:05 - 17:25 *ALMA's view of the initial conditions within a massive protocluster* - Jill Rathborne
17:25 - 17:45 *Globally collapsing molecular clouds as a formation mechanism for the most massive stars in the Galaxy* - Nicolas Peretto
17:45 - 18:05 *The dynamics and chemistry of massive starless cores* - Jonathan Tan
18:05 - 18:25 *The birth of a massive star G331.5-0.1* - Manuel Merello

Thursday, December 13, 2012

Session 2 : ISM and star formation (continuation)

09:00 - 09:45 *Chemistry of the interstellar medium and low mass star formation, Overview* - Naomi Hirano

09:45 - 10:05 *The first ALMA view of IRAS 16293-2422 proto-binary: Direct detection of infall onto source B and high resolution kinematics of source A* - Jaime Pineda

10:05 - 10:25 *Prebiotic molecules and water on solar system scales of low mass protostars* - Jes Jorgensen

10:25 - 10:45 *Deciphering VLA1623: a triple non-coeval system with a First Core candidate?* - Nadia Murillo

10:45 - 11:10 **Break**

11:10 - 11:30 *The largest circumstellar disk - Birth of a high-mass star?* - Rolf Chini

11:30 - 11:50 *Observations of the centimeter/(sub)millimeter H₂O masers in Orion KL with ALMA and VERA* - Tomoya Hirota

11:50 - 12:10 *Structure and effects of Environment in the outflow from massive YSO Orion Source I revealed by ALMA* - Ciriaco Goddi

12:10 - 12:30 *Outflow Entrainment in HH46/47* - Diego Mardones

12:30 - 14:00 **Lunch Break**

Session 3 : The high-z Universe

14:00 - 14:45 *First Galaxies and reionization, Overview*, Chris Carilli

14:45 - 15:05 *High redshift starburst galaxies revealed by SPT, ALMA, and gravitational lensing* - Joaquin Vieira

15:05 - 15:25 *Herschel-ATLAS and ALMA. An Einstein ring of molecular gas and dust in the z=1 source G15.v2.19* - Hugo Messias

15:25 - 15:45 *ALMA and JVLA observations of highly obscured infrared luminous jet-dominated quasars in a strongly AGN-dominated phase* - Carol Lonsdale

15:45 - 17:00 **Coffee + Poster viewing**

17:00 - 17:20 *ALMA reveals a chemically evolved submillimeter galaxy at z=4.76* - Tohru Nagao

17:20 - 17:40 *Probing the state of the ionized medium at high z with ZEUS and ALMA Band 9 early science* - Carl Ferkinhoff

17:40 - 18:00 *ALMA Band 7 observations of dense molecular medium in the type-1 active nucleus NGC 1097* - Kotaro Kohno

20:00 Popular talk open to public (in Spanish): *Un telescopio revolucionario en Chile: el proyecto ALMA y sus primeros resultados* (Rafael Bachiller)

Friday, December 14, 2012

Session 4 : Solar System and Protoplanetary Disks

09:00 - 09:45 *Solar System Science with ALMA, Overview*, Raphael Moreno

09:45 - 10:05 *Temporal monitoring of Saturn's 2011 Great Storm and its aftermath in 2011-2012 with Herschel and ALMA* - Thibault Cavalié

10:05 - 10:50 *Protoplanetary and debris disks, Overview*, Michiel Hogerheijde

10:50 - 11:20 **Break**

11:20 - 11:40 *Structure of transitional disks as revealed by ALMA* - Laura Perez

11:40 - 12:00 *Planet formation in action : resolved gas and dust images of a transitional disk and its cavity* - Nienke van der Marel

12:00 - 12:20 *An ALMA investigation of proto-planetary disks around young Brown Dwarfs* - Luca Ricci

12:20 - 14:00 **Lunch**

14:00 - 14:20 *Keplerian disk formation around protostars* - Nagayoshi Ohashi

14:20 - 14:40 *Unveiling the gas and dust disk structure in HD163296 using ALMA observations* - Itziar De Gregorio-Monsalvo

14:40 - 15:00 *ALMA estimate of the gap depth in the HD142527 protoplanetary disk* - Sebastián Perez

15:00 - 16:30 **Coffee + Poster viewing**

Session 5 : The Local Universe

16:30 - 17:15 *Galaxies in the Local Universe. Overview*, Chistine Wilson

17:15 - 17:35 *Molecular gas properties of M100 with ALMA* - Catherine Vlahakis

17:35 - 17:55 *Giant molecular clouds and star formation in the tidal molecular arm of NGC 4039* - Daniel Espada

20:00 Conference dinner at Hotel Patagónico

Saturday, December 15, 2012

Session 5 : The Local Universe (continuation)

09:00 - 09:20 *ALMA and Spitzer observations of the spectacular circumnuclear ring and starburst in the barred spiral NGC 1097* - Kartik Sheth

09:20 - 09:40 *Imaging the nearest circumnuclear starburst : ALMA observes NGC 253* - Alberto Bolatto

09:40 - 10:00 *ALMA imaging of the most luminous galaxy within $z = 0.01$* - Kazushi Sakamoto

10:00 - 10:20 *An ALMA and ATCA molecular line survey toward Centaurus A* - Juergen Ott

10:20 - 11:00 **Break**

11:00 - 11:20 *Zooming in on molecular clouds in 30 Doradus* - Remy Indebetow

11:20 - 11:40 *ALMA observations of 30 Doradus : Dense gas tracers HCO⁺, HCN and CS* - Crystal Brogan

11:40 - 12:00 *Probing the Galactic Centre with ALMA : The final frontier* - Anthony Rushton

12:00 - 13:30 **Lunch Break**

Session 6: Stellar Evolution

13:30 - 14:15 *Seeing stars with ALMA : Millimeter and Submillimeter probes of stars and stellar evolution, Overview*, Rachel Osten

14:15 - 14:35 *Investigating the coldest object in the Universe : ALMA observations of the Boomerang*

Nebula - Raghvendra Sahai

14:35 - 14:55 *Unwinding the secrets of thermal pulses and sculpted winds in AGB stars with ALMA* - Matthias Maercker

14:55 - 15:30 **Break**

15:30 - 15:50 *Resolving (sub)Millimeter emission from SN1987A* - Jon Marcaide

15:50 - 16:10 *Emission by rotational transitions of CO and SiO in the inner debris of Supernova 1987A* - Julia Kamenetzky

The future of ALMA Science

16:10 - 16:40 *Science priorities for the ALMA future* - Ryohei Kawabe

16:40 - 17:30 *Discussion: Science priorities for the future of ALMA*

17:30 - 18:00 *Conference Summary* Neal Evans

20:00 Popular talk open to public (in Spanish): *Mi experiencia en ALMA: La aventura de explorar el Universo frío* (Juan Cortés)

2.4 Meeting Photo



Fig. 1 Participants of the First Year of ALMA science conference:

2.5 Information of the EC financial contribution

The conference was co-sponsored by ESO, NAOJ, NRAO, the EC-FP7 *RadioNet3* project and CONYCIT.

RadioNet3 provided:

1. Folders and associated material
2. Financial support for the ALMA postdocs dinner
3. Partial travel support for
(Note: country code is for institute affiliation, not nationality):
 - Rafael Bachiller (Spain), Male
 - Thibaut Cavalier (France), Male
 - Simona Gallerani (Italy), Female
 - Ciriaco Goddi (Netherlands), Male
 - Nuria Huelamo (Spain), Female
 - Matias Lackington (United Kingdom), Male
 - Matthias Maercker (ESO), Male
 - Raphael Moreno (France), Male
 - Nicolas Peretto (France), Male
 - Tony Rushton (ESO), Male
 - Rebeca Aladro (ESO), Female