Observatorio Astronómico Nacional
Subdirección General de Astronomía, Geodesia y Geofísica
Instituto Geográfico Nacional

XL Young European Radio Astronomers Conference

This conference is sponsored by the National Geographical Institute of Spain (IGN) and the EC funded RadioNET FP7 proyect.

SOC & LOC

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Josús López Linares, FGUA (Spain)

Scientific program

Monday July 5th 2010

Morning - Arrival of participants.

Registration on arrival to Alcalá de Henares

13:00 - 15:00 *Lunch*

Scientific session 0: Introductory Talk

15:00 - 15:20 Welcome and introduction to YERAC

Scientific session I: Solar System

15:20 - 15:40 *D. Bezrukov*: The recovering procedures for radio maps of the sun.
15:40 - 16:00 *J. Girard*: Planetary studies with LOFAR and contribution to the development of a LOFAR Super-station.
16:00 - 16:20 *T. Bocanegra Bahamon*: Geodynamical studies of planetary moons with PRIDE (Planetary Radio Interferometry and Doppler Experiment).
16:20 - 16:40 *K. Mylostna*: Identification of Saturn lightnings registrated by UTR-2 radio telescope and spacecraft Cassini.

16:40 - 17:00 *Coffee Break*

Scientific session II: Star Formation and ISM

17:00 - 17:20 *M.A. Canay*: Chemical evolution in low-mass prestellar dense cores.
17:20 - 17:40 *S. Zahorecz*: The temperature of dense and cold cloud cores.
17:40 - 18:00 *P. Bjerkeli*: Observations and analysis of molecular outflows and shocks.
18:00 - 18:20 *A. López-Sepulcre*: A minimum surface density for OB star formation: An observational test.
18:20 - 18:40 *J. M. Mayén Gijón*: High Angular Resolution Observations of Ammonia Lines toward the Hot Molecular Core near G31.41+0.31.

Tuesday July 6th 2010

Scientific session II (Cont.): Star Formation and ISM

09:00 - 09:20 *F. Trotta*: Using mm observation to constrain variations of dust properties in circumstellar disks.
09:20 - 09:40 *I.D. Litovchenko*: 44 GHz methanol maser emission around SNR G27.4-0.16 and new detections of class I methanol masers in the direction of high-mass protostellar candidates.
09:40 - 10:00 *T. Hassall*: Low Frequency Pulse Scattering with LOFAR.

Scientific session III: Pulsars

10:00 - 10:20 *E. Keane*: Transient Radio Neutron Stars.
10:20 - 10:40 *E. Barr*: The Effelsberg Northern Sky Pulsar Survey.
10:40 - 11:00 *T. Coenen*: Single pulse search with LOFAR.

11:00 - 11:40 *Coffee Break*

Scientific session IV: AGNs, High-z and Cosmology

11:40 - 12:00 *F. Schinzel*: The quasar 3C 345 – an archetypical Active Galactic Nuclei.
12:00 - 12:20 *H. Denes*: A radio interferometric study of the high-redshift quasar J1715+2147.
12:20 - 12:40 *H. Rampadarath*: Hanny's Voorwerp: evidence for AGN activity and a nuclear starburst in the central regions of IC 2497.
12:40 - 13:00 *J. Rawlings*: Coeval Star Formation and Black Hole Growth in the Most Massive Galaxies.

13:00 - 15:00 *Lunch*

Scientific session IV (Cont.): AGNs, High-z and Cosmology

15:00 - 15:20 *K. Sokolovsky*: Estimating the magnetic field strength in AGN jets with multi-frequency VLBI.
15:20 - 15:40 *V. Vitrishchak*: Circular polarization studies of AGNs on the parsec VLBI scales.
15:40 - 16:00 *M. Mahmud*: Surprising evolution of Faraday rotation gradients in the jets of Active Galactic Nuclei.
16:00 - 16:20 *T. Pijloo*, The quest for peaked spectrum sources with LOFAR.
16:20 - 16:40 *R. van Loo*: Hunting for High redshift Radio Galaxies using LOFAR data.

16:40 - 17:00 *Coffee Break*

17:00 - 17:20 *E. Murphy*: Gleaning secrets from the transverse profiles of AGN jets.
17:20 - 17:40 *E. Kravchenko*: Ultra high energy neutrinos and its registration.
17:40 - 18:00 *K. Gereb*: WMAP point sources as space-VLBI calibrators.
18:00 - 18:20 *G. Gurkan*: A new path to time delays?

20:30 - 22:30 **YERAC 2010 Conference dinner**

Wednesday July 7th 2010

09:00 Busses leave Alcala de Henares towards Yebes Observatory.

10:00 - 12:00 Visit to the Yebes Observatory (40-m radiotelescope, laboratories, etc).

12:00 Group photo

12:30 - 14:00 *Lunch*

Scientific session V: Instrumentation and software

14:00 - 14:20 *J. M. Bergano*: Instrumentation Development for a 5GHz Receiver for a Radioastronomy experiment.
14:20 - 14:40 *B. Billade*: Heterodyne detection at millimeter wavelengths.
14:40 - 15:00 *B. Lew*: All Purpose Radio Imaging Cameras On Telescopes - software and simulations.
15:00 - 15:20 *D. Rossoni Mattos*: Design and fabrication of a fast, multi-bits analog-to-digital converter for astrophysics and cosmology applications.
15:20 - 15:40 *S. Kazemi*: Statistical algorithms in radio interferometric calibration.
15:40 - 16:00 *R. McFadden*: A New Method to Calibrate Ionospheric Pulse Dispersion for UHE Cosmic Ray and Neutrino Detection using the Lunar Cerenkov Technique.

16:00 - 16:40 *Coffee Break*

16:40 - 17:00 *B. Frank*: MeerKAT: Design, Simulation and HI Science.
17:00 - 17:20 *N. Lavonen*: Observation software development in Metsähovi Radio Observatory.
17:20 - 17:40 *V. Bezrukov*: Preparing VIRAC Radiotelescope RT-32 for receiving and processing signals related to Artificial Earth Satellites.

18:00 - 21:00 *Social event + BBQ dinner (BRING SWIMSUIT !!)*

21:00 Return to Alcalá de Henares

Thursday July 8th 2010

Scientific session VI: Galaxies and Clusters

10:00 - 10:20 *A. S. Abdullah*: Measuring HI content in six Lyman Break Analog Galaxies.
10:20 - 10:40 *R. Ianjamasimanana*: The HI super profiles of the THINGS galaxies. (cancelled)
10:40 - 11:00 *S. Bryan*: Luminous satellites in lenses.
11:00 - 11:20 *F. Costagliola*: Observing Molecules in Luminous Infrared Galaxies.

11:20 - 12:00 *Coffee Break*

12:00 - 12:20 *M. Rodriguez*: Global correlations in Galaxies.
12:20 - 12:40 *F. Lelli*: Structure and Dynamics of Giant Low Surface Brightness Galaxies.
12:40 - 13:00 *G. Macario*: Low frequency observations of diffuse radio emission in galaxy clusters.

13:00 - 13:10 **Closure of YERAC 2010**

13:10 - 15:00 *Lunch*

Afternoon - Departure of participants.

Abstracts of oral contributions

The recovering procedures for radio maps of the sun

D. Bezrukov (Ventspils International Radioastronomy Center), L. B. Ryabov (Ventspils International Radioastronomy Center) & L. A. Bajkova (Main Astronomical Observatory, Pulkovo)

The recovering procedures applied to solar microwave maps obtained by radiotelescope RT-32 of Ventspils International Radio Astronomy Center, Latvia are discussed. Taking to account that the Sun is too specific object for standard recovering procedures the Generalized Maximal Entropy Method (GMEM) is shown as optimal.

Planetary studies with LOFAR and contribution to the development of a LOFAR Super-station

J. Girard (LESIA - Observatoire de Paris), P. Zarka (LESIA - Observatoire de Paris), J. M. Griessmeier (ASTRON), & L. Denis (Unité scientifique de Nançay)

The LOFAR instrument has entered the commissioning phase. As members of the Working Group "Planets" of the Transient Key Project (TKP), we are now being involved in the data format and pipeline definition, test observations and feedback. Preliminary results of commissioning observations led on planetary targets (Jupiter and Saturn) will be presented. The raw output of several LOFAR stations were inspected as well as the performance of the incoherent sum mode (prior to the future coherent TAB (Tied Array Beam) mode). As we are focusing on the data handling, hardware response and station sensitivity, no new science is expected from the Jupiter observations. By contrast, Saturn data, that were taken during a phase of high lightning activity in the Kronian atmosphere may lead to unique measurements of Saturn's lighning duration, radio spectrum and energy. In parallel, an original new concept of an extended version of a standard LOFAR station (called the LOFAR Super Station-LSS) is studied at Nançay. Its design will consist of 96 new low-band antennas ($\sim$ 20 to 80 MHz) connected to the free input of the station back-end. Each new antenna will itself be a small analog phased array of about ten elements. Many advantages are expected from this new flexible instrument: contribution to LOFAR observations as an additional or alternate 'core' when used with other LOFAR stations (new shorter baselines and higher sensitivity of long baselines involving the LSS) and the ability to operate "offline" as a standalone instrument. Design studies as well as prototyping are currently ongoing with the purpose to demonstrate the feasibility of the concept. Some advances will be presented.

Geodynamical studies of planetary moons with PRIDE (Planetary Radio Interferometry and Doppler Experiment)

T. Bocanegra Bahamon (JIVE) & L. Gurvits (JIVE)

The Planetary Radio Interferometry and Doppler Experiment (PRIDE) is a multi-disciplinary enhancement of the scientific suite of several planetary science missions which are currently in various stages of preparation for launches in the next decade. The essence of PRIDE is the estimation of the state-vector of a spacecraft using VLBI tracking and multi-station Doppler measurements in phase-referencing mode. Elements of PRIDE have been demonstrated before in the VLBI experiment with the Huygens Probe carried out during its descent on the surface of Titan, observations of the ESA's lunar probe SMART-1 and Venus Express (VEX). By analysing 'live' VLBI data sets the aim is to develop and test PRIDE-related data-processing algorithms, for different scenarios. The outcome of these data will be used for modeling the gravity field of celestial bodies on the basis of the spacecraft state-vector. Based on a gravity field model conclusions can be drawn regarding the shape and internal structure of planets or planetary moons of interest. NOTE: This is not the final version of the abstract.

Identification of Saturn lightnings registrated by UTR-2 radio telescope and spacecraft Cassini

K. Mylostna (Institute of Radioastronomy of NAS of Ukraine), V. Zakharenko, A. Konovalenko, G. Fischer, J.âM. Griessmeier, P. Zarka, B. Ryabov, D. Vavriv, V. Ryabov, H. Rucker, P. Ravier, M. Sidorchuk, B. Cecconi, A. Coffre, L. Denis, C. Fabrice, R. Kozhyn, D. Mukha, L. Pallier, J. Schneider, V. Shevchenko, V. Vinogradov, R. Weber, & V. Nikolaenko

The work is devoted to investigations of Saturn electrostatic discharges (SED) according to simultaneous observations of the initial period of storm F on radiotelescope UTR-2 and spacecraft (SC) Cassini. Records on the UTR-2 were carried out using FFT-spectral receiver in the band 12-33 MHz, and on spacecraft Cassini - by means the serial spectrum analyser RPWS (Radio Plasma Wave Science) in the band 1.8-16 MHz. High degree of agreement between the results of ground-based and space data was obtained. E-folding time of SED and its dependence of episode intensity in the initial period of storm F were defined.

Chemical evolution in low-mass prestellar dense cores

M.A. Canay (Observatorio Astronomico Nacional) & M. Tafalla (Observatorio Astronomico Nacional)

Observations in the last decade have shown an inhomogeneous chemical composition in dense cores, which are the simplest star-forming sites. Low-mass starless cores develop an abundance gradients with time, and several species vanish toward the core center. This fact has been interpreted as resulting from the depletion of molecules onto dust grains and ion-molecule reactions that occur in the gas phase. At the high densities ($>10^4$ cm^{-3}) and low temperatures ($\simeq$ 10 K) of the core interiors, molecules like CO and CS stick onto the dust grains and thus disappear from the gas phase. However, nitrogen-bearing molecules like N_2H^+ and NH_3 appear overabundant in the central regions, because of their sensitivity to CO depletion. Thus, N_2H^+ and NH_3 have become indicators of the evolutionary state of dense cores. Observations of the N_2H^+ and NH_3 emission of about ten dense cores have been carried out in order to study their abundances and their time evolution during the contraction phase of the cores.

The temperature of dense and cold cloud cores

S. Zahorecz (Eotvos University), L. V. Toth (Eotvos University), A. Zsom (MPIA Heidelberg), G. Marton (Eotvos University), N. Szalai (Eotvos University), E. Verebelyi (Eotvos University), M. Juvela (Helsinki University), A. Kawamura (Nagoya University), C. Kiss (Konkoly Observatory Budapest), M. Tamura (Nagoya University) & M. Ueno (Nagoya University)

High S/N observations provide evidence for temperature variation in molecular cloud cores. We have determined the gas density and kinetic temperature in a number of nearby dense molecular cloud cores from ammoina rotation inversion line observations (Effelsberg-100m). Besides, dust temperatures have been derived from ISO, AKARI FIS and Planck-Herschel Science Demonstration Phase measurements. We have modelled the dense cores using Monte Carlo simulations. Associated point sources have been searched also in AKARI catalogues.

Observations and analysis of molecular outflows and shocks.

P. Bjerkeli (Onsala Space Observatory)

Observations of water in molecular outflows and shocks have been carried out using the Odin satellite. A non-LTE radiative transfer code has been used to estimate the ortho-water abundance in seven molecular outflows and one super-nova remnant. Elevated abundances are found in several sources, as expected from continuous type shocks. Also a correlation between the maximum outflow velocity and the abundance is found. An ongoing project will also be prestented. An Accelerated Lambda Iteration code (ALI) is used to model bow-shock geometries. Varying the ortho-water abundance, line profiles are computed for various gas densities and kinetic temperatures. The ALI code is used to interpret the observations from the Herschel Space Observatory.

A minimum surface density for OB star formation: An observational test

A. Lopez-Sepulcre (INAF -OAA), R. Cesaroni (INAF -OAA), M. Walmsley (INAF -OAA), & C. Codella (INAF -OAA)

Recent theories predict that high-mass star formation may occur only above a minimum surface density of the parental molecular clump. With this in mind, we have searched for OB star formation signposts (mainly infall and outflow signatures) in a sample of 49 massive molecular clumps (M $>$ 100 $M_{\odot}$), including both IR-dark and IR-loud sources and covering a wide range of surface densities. The aim was to look for evolutionary trends and test observationally the above mentioned theoretical prediction. Each of these sources has been mapped in the HCO+(1-0), HCN(1-0), and C18O(2-1) lines with the IRAM-30m telescope in Pico Veleta (Spain), and subsequently observed in the SiO(2-1) and (3-2) lines (molecular jet tracers). I will present the results obtained from this survey, which in short lend support to the theoretical prediction.

High Angular Resolution Observations of Ammonia Lines toward the Hot Molecular Core near G31.41+0.31

J. M. Mayén Gijón (Instituto de Astrofísica de Andalucía), G. Anglada (Instituto de Astrofísica de Andalucía), M. Osorio (Instituo de Astrofísica de Andalucía) J. F. Gómez (Instituto de Astrofísica de Andalucía) & C. Carrasco (Instituto de Astrofísica de Andalucía)

The early stages of massive star formation are still poorly understood. In the last decade hot molecular cores (HMCs) have attracted a lot of interest since they may represent the youngest phase yet observed in the life of a massive star. HMCs are small, dense, hot and dark molecular clumps generally found in the proximity of UCHII regions and it is believed that their heating source could be a recently formed high-mass star undergoing an intense accretion phase. To understand the formation mechanism is crucial to determine their structure and kinematics (outflows, infall and rotation). We present subarsecond VLA ammonia observations of high excitation transitions of the HMC in the star forming region G31.41+0.31. We compare the results of our observations with a detailed modeling of the source to infer the physical parameters of the core.

Using mm observation to constrain variations of dust properties in circumstellar disks

F. Trotta (Florence University) & L. Testi (ESO)

Grain growth in protoplanetary disks is the first step towards the formation of the rocky cores of planets. Dust evolution models predict that grains grow, migrate and fragment in the disk and predict varying dust properties as a function of radius, disk age and physical properties. To constrain grain growth and migration in protoplanetary disks high-angular resolution observations at more then one (sub-)mm wavelength are currently being performed to detect possible radial variations of the dust properties. I will present the predictions of the dust evolution models for a range of parameters and discuss the possibility of constraining dust properties with millimeter high angular resolution observations.

44 GHz methanol maser emission around SNR G27.4-0.16 and new detections of class I methanol masers in the direction of high-mass protostellar candidates

I.D. Litovchenko (Astro Space Center of & Russia, Lebedev Physical Institute), A.V. Alakoz & I.E. Valtts

To test the models of class I methanol maser formation it is necessary to have a large sample of maser sources associated with different astrophysical objects. SNRs could be involved in the forming of these masers taking in mind collisional pumping supposed for them. No special search for methanol emission towards SNRs have been done before, though precedents of SNRs associations with class I methanol emission are available - for example, in known star-forming regions W43, W44, and W51. A search for maser emission in the vicinity of already known maser source, associated with an SNR, seems to be the optimal strategy to search for such kind of associations. In December 2009 mapping of the methanol maser, which is formed in the environment of a supernova G27.4-0.16 was conducted with 20-m Onsala radio telescope. At the frequency of 44 GHz this maser was observed for the first time. In addition, a survey of some regions of high mass protostellar candidates was conducted, number of new masers were discovered.

Low Frequency Pulse Scattering with LOFAR

T. Hassall (University of Manchester), B. Stappers (University of Manchester), A. Alexov (ASTRON), A. Askegar (ASTRON), T. Coenen (Universiteit van Amsterdam), J. Hessels (ASTRON), A. Karastergiou (University of Oxford), V. Kondratiev (ASTRON), M. Kramer (Max-Planck-Institut für Radioastronomie), J. Van Leeuwen (ASTRON) & A. Noutsos (Max-Planck-Institut für Radioastronomie)

Propagation effects due to the Interstellar Medium (ISM) are at their most prominent at low frequencies. Below a few hundred MHz pulse profiles are particularly affected by scattering, which causes pulse broadening with a timescale proportional to ν^{-4}. In pulsars with a lot of scattering material in their line of sight the broadening timescale can even exceed the pulse period, making the pulsar undetectable. In those pulsars that are detected however the scattered pulse profile can be used as an interesting probe of the ISM. LOFAR is a new telescope which has unprecedented bandwidth and sensitivity below 200MHz, making it an ideal tool for studying scattering. In this presentation I will talk about my work on scattering using observations taken during the comissioning phase of LOFAR.

Transient Radio Neutron Stars

E. Keane (University of Manchester)

I will review the current status of searches for Rotating Radio Transients (RRATs), a recently discovered class of transient radio neutron star. These stars appear to be as abundant as the well-known radio pulsars, something which may be difficult to reconcile with the Galactic supernova rate. To investigate where RRATs fit in a neutron star evolutionary sense, as well as to investigate their unusual intermittent emission it is important to identify many more sources. To this end I will discuss a recent re-analysis of the Parkes Multi-beam Pulsar Survey which has more than doubled the known sources in the survey. I will also describe the unusual timing behaviour of RRAT J1819-1458 and present timing solutions for some of the newly discovered sources. These leads to an examination of where RRATs live in period-period derivative space and the spin-evolution of pulsars and magnetars.

The Effelsberg Northern Sky Pulsar Survey

E. Barr (MPIfR)

Pulsars are rapidly rotating neutron stars which emit beams of broadband radio emission from their magnetic poles. The extreme conditions found in and around pulsars make them a fantastic natural laboratory through which many aspects of fundamental physics and astronomy can be probed. Whether it is an exotic pulsar which pushes the limits of the equation-of-state, a highly accurately timing millisecond pulsar (MSP) that can be used as part of an array to detect gravitational waves or a normal pulsar that will help map the interstellar medium, the discovery of new pulsars inevitably leads to an improvement in our understanding of one or more research areas. Presented here are the fundamentals of pulsar searching in the radio regime, with focus on the ongoing Effelsberg pulsar survey which employs the 100-m Effelsberg Radio Telescope to comprehensively survey the northern sky with unparalleled sensitivity.

Single pulse search with LOFAR

T. Coenen (Universiteit van Amsterdam)

LOFAR, the LOw Frequency ARray, is a large new radio telescope array. The core of the array is situated in the Netherlands, but LOFAR also has stations in other parts of western Europe. LOFAR's sensitivity and wide field of view allow it to monitor the sky for faint radio transients varying as fast as milliseconds. We will thus use LOFAR to survey the entire sky for new radio pulsars. Some of these intrinsically periodic pulsars are best detected through sporadic bright individual pulses. I will describe the LOFAR pulsar processing pipeline, the single pulse search software I am developing, and some early single-pulse search results.

The quasar 3C 345 – an archetypical active galactic nuclei

F. Schinzel (MPIfR), A. P. Lobanov (MPIfR) & J. A. Zensus (MPIfR)

The quasar 3C 345 (redshift z=0.59) is one of the best studied "superluminal" radio sources, showing structural and emission variability on parsec scales around a compact unresolved radio core. For over 30 years, it has been closely monitored with very long baseline interferometry (VLBI), yielding a wealth of information about the physics of relativistic outflows and dynamics of the central regions in AGN. During the last 2 years, the source has been undergoing a period of high activity ranging from the radio to high-energy bands. I will present preliminary results on the recent radio flaring activity in 3C 345, discussing trajectories, kinematics, and flux density evolution of enhanced emission regions embedded in the jet. I will show evidence for a connection of the jet activity with observed flux variability at other wavelengths (Optical, X-ray, Gamma-ray) and will present results from our first attempt to localize the emission region of gamma-rays.

A radio interferometric study of the high-redshift quasar J1715+2147.

H. Dénes (Eötvös Loránd University)

The high-redshift quasar J1715+2145 (z=4.01) has an unusually extended radio jet structure revealed with VLBI observations. Moreover, within one arcminute angular separation, there appears another radio quasar, approximately in the direction of the continuation of the jet. This is a very rare and potentially interesting phenomenon. The two quasars might in principle be physically related, or the images might be due to gravitational lensing. To investigate these possibilities, I analysed archive radio interferometric (VLA) data of the two sources in five radio wavelength bands (L, C, X, U, K bands). According to the flux densities measured in the different bands, the spectral indices of the two sources are different, so they are not gravitationally lensed. Furthermore, a third radio source appears in the VLA images, next to the secondary quasar, about 10 arcseconds north from it, which might be a jet component. I also collected information on the two quasars at other electromagnetic wavebands from archives. The Chandra X-ray and the ISO infrared data also prove that the two seemingly close quasars cannot be gravitationally lensed images. Although there is no measured spectroscopic redshift available for the secondary quasar, based on photometric information, the two quasars are at different redshifts. Both the gravitational lensing interpretation and the physical association are ruled out: the two apparently nearby radio quasars are the result of a projection.

Hanny's Voorwerp: evidence for AGN activity and a nuclear starburst in the central regions of IC 2497

H. Rampadarath (JIVE & Leiden), M. Garrett (ASTRON & Leiden), G. Jozsa (ASTRON), T. Muxlow (JBCA), T. Oosterloo (ASTRON & Groningen), Z. Paragi (JIVE), R. Beswick (JBCA), H. van Arkel (ASTRON), W. Keel (Alabama University) & K. Schawinski (Yale University)

Hannyâs Voorwerp is an irregular gas cloud located 25 kpc from the massive spiral galaxy IC2497. In the optical the Voorwerp is dominated by O III emission lines, and its spectrum shows strong emission with high ionisation lines. Paradoxically, there is no evidence for an ionisation source in the immediate proximity of the Voorwerp. To explain this phenomena two hypotheses have been proposed: the Voorwerp may be the first example of a quasar light echo or IC2497 contains a weak but obscured AGN, that is illuminating the Voorwerp. To test the latter, recent radio observations of IC2497 are presented. EVN observations at 18 cm, reveal the presence of two compact radio sources within IC2497, (C1 and C2). The brightness temperature of C1 and C2 suggests AGN activity. MERLIN observations at 6 cm, detects only component C2. C2 is shown to have a flat radio spectrum, strongly suggesting that C2 is a compact radio core of an AGN. MERLIN observations at 18 cm, show both components, connected via diffuse extended emission, which is interpreted as the signature of nuclear starburst. Comparison of the extended radio and total FIR luminosity shows that IC2497 lies on the FIR-radio correlation (q=2.2). The associated massive star formation rate is 16M/yr, almost an order of magnitude greater than M82. Our results strongly suggest that IC2497 contains an AGN, embedded in a nuclear starburst. We propose that while the AGN is heavily obscured towards the observer, the line of-sight in the direction of the Voorwerp is unobscured. The Voorwerp is also part of a large reservoir of gaseous debris in the vicinity of IC497 that is directly ionised by the illumination cone of the AGN.

Coeval Star Formation and Black Hole Growth in the Most Massive Galaxies

J. Rawlings (Mullard Space Science Laboratory, University College London), N. Seymour (University College London) & M. Page (University College London)

High redshift radio galaxies (HzRGs) are known to be among the most massive galaxies in the Universe and host a powerful radio-luminous active galactic nuclei (AGN) at their center. Using mid infra-red (IR) spectra obtained from the Infra-Red Spectrometer (IRS) instrument on-board Spitzer, we aim to observe evidence of rapid star-formation inside these galaxies to compare the relative contribution of AGN activity and star formation to their bolometric output. We will measure the rate of this star-formation by observing spectral features such as polycyclic aromatic hydrocarbon emission (PAHs) and also measure the silicate absorption. We shall also determine the power of the AGN from their rest-frame IR luminosities. This work will enable us to better understand the connection between AGN and star-formation activity by measuring the coeval growth of the black hole and host galaxy in these distant rare sources.

Estimating the magnetic field strength in AGN jets with multi-frequency VLBI

K. Sokolovsky (MPIfR)

Spatially resolved broad-band spectroscopy with Very Long Baseline Interferometry (VLBI) offers a tool to probe physical conditions inside extragalactic relativistic jets. I will describe a method for estimating magnetic field strength in different jet regions by fitting theoretical synchrotron spectrum to multi-frequency VLBI images on a pixel-by-pixel basis. I will discuss challenges in application of this method and present first results obtained from single- and multi-epoch VLBA observations of selected bright blazars. Preliminary analysis indicates that most of the objects observed have magnetic fields B¡10 G on parsec scales.

Circular polarization studies of AGNs on the parsec VLBI scales

V. Vitrishchak (Sternberg Astronomical Institute of Moscow State University), I. Pashchenko (Sternberg Astronomical Institute of Moscow State University and Lebedev Physical Institute RAS) & D. Gabuzda (University College Cork)

Parsec-scale radio circular polarization (CP) studies of AGNs may provide important information about internal parameters of jets and central machine, which cannot be obtained otherwise. As long as circular polarization is not a subject to almost any external effects (as linear polarization is) and it strongly depends on the internal parameters of the source itself, it opens a new possibility of estimating these parameters. We present the results of multi-frequency radio CP studies of large AGN sample and briefly discuss the different mechanisms of CP generation. Some preliminary and mostly qualitative conclusions are made from analyzing the observed CP signal concerning magnetic field properties, jet plasma composition, jet generation mechanism e.t.c.

Surprising Evolution of Faraday Rotation Gradients in the Jets of Active Galactic Nuclei

M. Mahmud (JIVE) & D. C. Gabuzda (University College Cork)

Several studies have shown systematic Faraday Rotation gradients across the parsec-scale jets of a number of Active Galactic Nuclei, interpreted as evidence for helical magnetic (B) fields- the gradients were taken to be due to the systematic variation of the line-of-sight B field across the jet. I present here results for parsec-scale Faraday Rotation Measure (RM) distributions for several of these sources, confirming previous results and showing interesting new features. We observe transverse RM gradients across the jets of several of these sources (as expected, if they have helical magnetic fields), and confirm the presence of the gradients over time and at different wavebands. Furthermore, I will also discuss an interesting new feature observed with the RM distributions in some of these sources: a reversal in the direction of these gradients that happens either with distance from the core or over time in the jet! This provides new evidence to support "magnetic-towe" type models in which field lines emerging from the central region of the accretion disk and closing in the outer region of the accretion disk are both "wound up" by the differential rotation of the disk. This provides new insights about the geometry of the jet B fields, confirmation that these gradients are dynamic, and also evidence for the Poynting-Robertson Battery model of Contopoulos and Kazanas (1998).

The quest for peaked spectrum sources with LOFAR

T. Pijloo (Sterrewacht Leiden)

Besides the large-scale powerful Fanaroff and Riley (FR) I and II radio sources, $\sim$ 40% of the luminous (centimeter-wavelength-selected) radio source population is made up by the less well understood compact radio sources. These gigahertz peaked-spectrum (GPS) and compact steep-spectrum (CSS) sources make up $\sim$ 10% and $\sim$ 30% of this population, respectively, are powerful and are characterized by convex radio spectra (O'Dea 1998). The spectra of GPS sources peak between $\sim$ 0.5 and $\sim$ 10 GHz (observer's frame) and the spectra of CSS sources peak $<$ 500 MHz. The peaks in the radio spectra are thought to be due to synchrotron self-absorption (SSA), although free-free absorption (FFA) may also play its part. In this contribution peaked sources are studied in a 8 by 8 degree wide field centered at 3C61.1 observed with the LOFAR Radio Telescope. With its high resolution (e.g. a resolution of better than $1''$ at 240 MHz) and its superb sensitivity, LOFAR will be sensitive to possibly the most distant CSS sources, of which their spectral turnovers have redshifted down to the lowest observable radio frequencies (Snellen et al. 2008). With this LOFAR data, containing a large amount of radio sources, the aim is to determine the number of CSS sources as a function of turnover frequency (as a statistical overview) and to investigate whether the convex spectra are caused merely by SSA or whether FFA also plays a part. The CSS sources are most likely the young counterparts of the FR I and II sources and both statistical and analytic knowledge about these sources will provide key information about the origin and evolution of powerful radio sources.

Hunting for High redshift Radio Galaxies using LOFAR data

R. van Loo (Leiden Observatory)

For my bachelor-research I have worked with data from LOFAR (LOw Frequency ARray) to try to find steep spectrum sources in the 3C61 field of about 8x8 degrees. LOFAR is the new radio interferometer mainly located in the Netherlands and is at the moment not yet fully deployed. So the calibration of LOFAR-data is still in its infancy. Steep spectrum sources are interesting because their steep spectrum relates to a high redshift. This relation is an empirical one and the origin of this effect is not yet fully understood. These steep spectrum sources are often very large radio galaxies. The steeper the spectrum, the higher the redshift, the earlier in the Universe, and thus these sources could provide information about the emergence of large scale structures in the Universe, because these High redshift Radio Galaxies (HzRGs) are among the fist galaxies evolved out of the dark ages. They are also among the largest, most luminous and most massive objects in the Universe which makes them even more interesting. The goal of my research was determining the spectra and the steepness of those spectra for all the sources in the 3C61 field using LOFAR-data to try to find HzRG-candidates. However, this was very difficult, because of the fact that LOFAR is not yet fully calibrated nor fully deployed. So I have mainly investigated the data, trying to find a good calibration method for determining spectra en trying to determine the frequency-dependence of the primary beam. I can conclude to say that at this stage it is not yet possible to determine adequate spectra using only LOFAR-data.

Gleaning Secrets from the Transverse Profiles of AGN Jets

E. Murphy (University College Cork) & D. Gabuzda (University College Cork)

Both the emission properties and evolution of Active Galactic Nuclei radio jets are dependent on the magnetic fields that thread them. A better understanding of these magnetic fields is therefore important in helping our understanding of jets in AGN. Several observations of jets have suggested that, on parsec scales, the magnetic field threading the jet may have a significant helical component. Using a model first proposed by R.A Laing and developed by Papageorgiou and Cawthorne, all of the above observations can be clearly seen by varying only the helical pitch angle of the magnetic field and the line of sight angle. In order to reduce the total polarization to agree with observed values, a tangled magnetic field component is also introduced to the model. This tangled magnetic field introduces another parameter to the model, the degree of entanglement. The model predicts four different types of polarization angle configuration., longitudinal all across, longitudinal on one side, transverse on the other, transverse near the centre and longitudinal on the edges and transverse all across. For my PhD. I will be comparing data from observations of several AGN with this model, making it possible to derive values for the helical pitch angle, the line of sight angle and the degree of entanglement for these jets. I am writing an algorithm which will compare the observed profiles to a massive databank of theoritical profiles in order to best estimate these values. This should enable analysis of a large number of AGN jets, making it possible to look for trends. Comparing the observed and theoretical profiles will also provide information about how the model can be improved.

Ultra high energy neutrinos and its registration

E. Kravchenko (Pushchino Radio Astronomy Observatory)

My talk is devoted to ultra high energy neutrinos and methods of its registration. Such neutrinos are of special interest, because its investigations provide a key about process, taking place in heart of astrophysics sources, and composition and evolution of the Universe. This range of energy is out of reach for any thinkable Earth-based experiments on colliders. That is way investigation of such neutrinos is significant for solving of a base questions in astrophysics and elementary particle physics. Such ultra high energy neutrinos can be produced as byproducts of cosmic rays propagation through Universe, of decay and interactions of dark matter particles or topological defects, and in astrophysical sources. Because of neutrino is charged free and weakly interact with matter, to detect one it is widely used a huge essential volumes, like the Antarctic ice, sea water and salt domes. There are a lot of neutrino registration methods, like Cherenkov emission (light and radio) and acoustic vibrations (sound). Nowadays there are many working and projected experiments, the aim of which is investigation of cosmic rays and neutrinos. It is also my subject for speech.

WMAP point sources as space-VLBI calibrators

K. Geréb (Eötvös Loránd University)

I have been investigating the five-year WMAP point-source data (Chen & Wright 2009, ApJ 694, 222) to create a new catalogue of bright and compact quasars to be potentially studied with mm-VLBI. After comparing the WMAP data with the existing VLBI catalogues, I have sorted out the new sources, and created new samples regarding the WMAP sourceâs appearance in the VLBI catalogues. Using the 41, 61 and 94 GHz WMAP flux densities, I calculated the spectral indices, and made the flux density and spectral index histograms of the whole WMAP catalogue and some of the sub-samples. An important aim of my work is to identify new bright quasars, which will be available for observation in the future at 86 GHz with VLBI technique. To create such a list, I chose WMAP sources which had not been investigated at 86 GHz before, with flux densities above 1 Jy, with declination above -40^o to have a good radio station coverage. (The method was adopted from Lee at al. 2008, AJ 136, 159). I used public databases to do the optical identifications in my new list, and I searched for wider band radio spectra, and earlier lower frequency VLBI images. In the future, satellites like ASTRO-G which will provide higher resolution and better sensitivity than surveys before, could use the bright quasars of my new catalogue as calibrators for the observation of faint sources.

A new path to time delays?

G. Gurkan (University of Manchester) N. Jackson (University of Manchester) I. Browne (University of Manchester), L. Koopmans (Groningen University), C. Fassnacht (University of California) & A. Berciano Alba (JIVE)

To better understand the universe and its dynamics, the Hubble constant is a crucial parameter which provides valuable information about the expansion rate of the universe. So far, the Hubble constant has been determined by various methods such as Cepheid variables by utilizing HST Key Project data and WMAP. The accuracy of the Hubble constant value is not better than 10% due to intrinsic constraints/assumptions of each method. Gravitational lens systems provide another probe of the Hubble constant using time delay measurements. Current investigations of time delay lenses have resulted in different values of Ho ranging from 50-80 km/s/Mpc. The main problem in gravitational lens systems is that requires a mass model for the lens which is difficult to measure independently unless observational constraints are available. Moreover, in order to see time delays clearly, fluxes of sources have to be variable. On the other hand, using a typical value of the Hubble constant and measured time delays enable us to determine a better/more accurate mass model for the lens galaxy. Here we attempt to develop a new and more efficient method for measuring time delays, which does not require regular monitoring with a high-resolution interferometer array or with optical telescopes. Instead, the WSRT is used for flux monitoring of double image lens systems in which the brighter image is expected to vary first. Triggered VLA observations can then be used to catch the subsequent variability of the fainter image.

Instrumentation Development for a 5GHz Receiver for a Radioastronomy experiment.

J.M. Bergano (Instituto de Telecomunicacoes), L. Cupido, D. Barbosa, R. Fonseca, & G. Smoot

In the context of the Galactic Emission Mapping, a new receiver at 5GHz is being developed to characterize the galactic foreground to the Cosmic Microwave Background Radiation. This is a 5GHz super heterodyne polarimeter with double down conversion, with a high gain IF chain using the latest RF technology working at 600MHz central frequency that feeds a four channel digital correlator. This paper describes the receiver current status and the implementation of LNAs using commercial transistors. Design options and constraints are presented with some simulations and experimental results of a circuit prototype.

Heterodyne detection at millimeter wavelengths.

B. Billade (Chalmers University of Technology), A. Pavolotsky & V. Belitsky

Millimeter wave radio astronomy receivers usually employ non-linear characteristics of a Superconductor-Insulator-Superconductor (SIS) tunnel junction for heterodyne detection. At frequencies ranging from 100 GHz upto 1 THz, sensitivity of SIS based receivers completely outperforms any other available technology. SIS mixers use highly non-linear I-V(current-voltage) characteristics of the SIS tunnel junction to facilitate quasi particle photon assisted tunneling. In SIS mixers a very sharp current onset can be observed when the applied bias exceeds a threshold voltage called the Gap-Voltage. This sharp onset in the current is observed when the energy of the applied electromagnetic radiation hf/e exceeds the threshold voltage. When SIS tunnel junction is biased at a voltage slightly below the Gap-Voltage such that an incoming photon provides energy (Vbias+hf/e) > Gap-Voltage, quasi particle tunneling occurs. In this region SIS is responsive to a single photon, providing ultimate sensitivity. Atacama Large Millimeter Array (ALMA), is a new generation radio interferometer under construction. ALMA will operate in ten frequency bands covering frequencies from 31GHz to 950GHz. Located at 5000 meters above sea level in the Atacama desert in Chile, where the earth's atmosphere provide the most favourable conditions for observations at these frequencies, with its more than 60 antennas of 12 m diameter and a reconfigurable baseline ranging from 150 m to 18 Km, ALMA will provide unprecedented sensitivity and resolution. At the conference we plan to present the design and development of SIS mixer for ALMA Band 5, one of the 10 frequency bands of the ALMA project.

All Purpose Radio Imaging Cameras On Telescopes - software and simulations

B. Lew (Nicolaus Copernicus University)

Radio receivers gradually evolve from single beam dedicated systems to multi-beam all purpose arrays of receivers that multiply our capabilities of fast surveying the sky by cataloguing populations of radio-sources, mapping extended diffuse galactic emissions or exploring S-Z effects on clusters of galaxies. In my talk I will present a short overview of the APRICOT project and specifically focus on task 5 â simulations and software development with application for future radio surveys. I will outline the major problems, plans and current status.

Design and fabrication of a fast, multi-bits analog-to-digital converter for astrophysics and cosmology applications

D. Rossoni Mattos (Bordeaux 1 University)

A new high-speed analog-to-digital converter (ADC) is being designed to anticipate the needs of future broad band millimeter/submillimeter observations and of new measurements instruments. Our goal is to prototypee a device with 6-bit resolution and 8 GHz sampling frequency for the same 8 GHz analog input bandwidth. Our design represents a significant evolution in comparison with the current ADCs, including the ADC which was developed for the ALMA project (3 bits only at 4 GHz sampling). A "flash" architecture has been chosen to meet the requirements in terms of speed and a track-and-hold (T&H) block has been integrated in the overall design to reduce the ADC time constraints. The T&H has already been fabricated in CMOS 65nm technology from STMicroelectronics and fully tested in the laboratory on a specifically designed test board. A 1:4 demultiplexing block is also integrated in our ADC design to decrease the LVDS output data-rate and thus facilitate the full device testing and further processing of the digitzed signal.

Statistical algorithms in radio interferometric calibration

S. Kazemi (Kapteyn Astronomical Institute), S. Yattawata (Kapteyn Astronomical Institute) & S. Zaroubi (Kapteyn Astronomical Institute)

Radio interferometry is an essential method for astronomical observations. Self calibration techniques have increased the quality of the radio astronomical observations (and hence the science) by order of magnitude. Recently, there is a drive towards sensor arrays built using Radio astronomy involves using radio antennae for studying celestial objects at radio frequencies. Initially, each single antenna had been used singularly for astronomical observations. This approach of observation was improved using radio interferometry with multiple linked antennae which are called radio synthesis arrays. Calibration of such arrays is basically finding the maximum likelihood estimate of the unknown instrument and the sky parameters, and correcting them before imaging. We present some efficient statistical algorithms, such as Levenberg Marquardt (LM), Expectation Maximization (EM), and Space Alternating Generalized Expectation Maximization (SAGE) algorithms which can be utilized for radio interferometric calibration. Moreover, we use the Akaike's Information Criterion (AIC) to identify the optimal number of sources in the sky for a given observation to make a proper calibration. At the end, the Kullback Leibler Divergence (KLD) as well as Likelihood Ratio test are applied to evaluate the amount of statistical similarity between the solutions which can be considered as the amount of solver noise in the calibration process.

A New Method to Calibrate Ionospheric Pulse Dispersion for UHE Cosmic Ray and Neutrino Detection using the Lunar Čerenkov Technique

R. McFadden (ASTRON) & R. Ekers (ATNF)

UHE particle detection using the Lunar Čerenkov Technique aims to detect nanosecond pulses of Čerenkov emission which are produced during UHE cosmic ray and neutrino interactions in the Moon's regolith. These pulses will reach Earth-based telescopes dispersed, and therefore reduced in amplitude, due to their propagation through the Earth's ionosphere. To maximise the received signal to noise ratio and subsequent chances of pulse detection, ionospheric dispersion must therefore be corrected in real-time. This requires an accurate knowledge of the dispersion characteristic which is parameterised by the instantaneous Total Electron Content (TEC) of the ionosphere. I will present a new method to calibrate the dispersive effect of the ionosphere on lunar Čerenkov pulses. This method exploits radial symmetries in the distribution of the Moon's polarised emission to make Faraday rotation measurements in the visibility domain of synthesis array data (i. e. instantaneously). Faraday rotation measurements are then combined with geomagnetic field models to estimate the ionospheric TEC. This method of ionospheric calibration is particularly attractive for the lunar Čerenkov technique as it may be used in real time to estimate the ionospheric TEC along a line-of-sight to the Moon.

MeerKAT: Design, Simulation and HI Science

B. Frank (University of Cape Town), E. de Blok (University of Cape Town), & D. Shepherd (NRAO/SKA-SA)

MeerKAT is South Africa's 1% SKA demonstrator interferometer. The 80 dish telescope is designed to be a versatile instrument ideal for a wide range of science cases. I will provide some insights into the configuration design and the simulation study currently being started. From a scientific perspective, I will also provide an overview of some of the large HI science cases that are being planned for MeerKAT, as well as some results from my current work in the comparison of HI and CO dynamics of local galaxies.

Observation software development in Metsähovi Radio Observatory

N. Lavonen (Aalto University Metsähovi Radio Observatory)

Since 1980 Metsähovi Radio Observatory has made continuous observations of a set of approximately 85 quasars at frequencies ranging from 22 GHz to 87 GHz with its 13,7-meter radio telescope. These unique high frequency long term observations provide valuable time series data for studying the behavior and structure of quasars. In order to ensure high quality of data, properly timed and high quality observations are needed every day of the year. As MetsÃ?hovi does not have dedicated staff for conducting observations with the telescope, researchers, students and assistants working in Metsähovi all have to conduct observations parallel to their other work. To minimize the staff's workload and to maximize data quality, efforts have been made throughout Metsähovi's history towards the automatization of observations. The goal of automatic or semi-automatic observations sets challenges for the software that is used to conduct the observatons; it has to be simple and smart enough to be operated by a novice summer employee observer, but has to give full control to a veteran observer with decades of experience. It also has to be able to utilize the armada of weather and other sensors in use at MetsÃ?hovi in a way that gives relevant information to the observer about the observing conditions. I will present these challenges, and the solutions MetsÃ?hovi has come up with, or is planning to implement, in order to face them.

Preparing VIRAC Radiotelescope RT-32 for receiving and processing signals related to Artificial Earth Satellites.

V. Bezrukovs (Ventspils International Radio Astronomy Centre) & I. Shmelds (Ventspils International Radio Astronomy Centre)

In last december (December, 2009), VIRAC (Ventspils International Radio Astronomy Centre) started three years project "Signals related to Artificial Earth Satellites: Technologies of Receiving, Transmitting and Processing". This project combines three research directions. The first direction is aimed at a feasibility study for reconstruction of the telescope RT-16, includes research in the fields of electronics, mechanics and mathematical modelling. The second direction is developing and applying methods for processing of recorded data. The third direction is connected directly with the space debris radiolocation using the radio telescope RT-32 and the VLBI techniques. Also by this research group being developed software correlator for VLBI data processing and software for computing the orbital elements and future coordinates of the observed objects (debris). Space debris radiolocation will be organised with the collaboration with other radio telescopes from LFVN. Correlation of the data will be carried out, using VUC (Ventspils University College) cluster with designed software correlator. Here are presented the preliminary results of studies carried out by the third group connected to radio telescope RT-32 preparation to the VLBI observations and to the development of the software correlator and associated software.

Measuring HI content in six Lyman Break Analog Galaxies

A.S. Abdullah (Leiden Observatory), H. Rottgering (Leiden Observatory) & R. van Weeren (Leiden Observatory)

In theories of galaxy formation and evolution the amount of cold gas available for star formation is a key parameter. However, because of the strong redshift limit of z 0.25 posed by HI surveys, studies of galaxy evolution at high redshift have relied mainly on the direct and dust processed light from stars or molecular (CO) gas. Due to the strong decline in the cosmic star formation rate (SFR) and galaxy evolution with redshift, the nearby universe is largely devoid from galaxies from galaxies that could be used to represent the high redshift population. For example, local starburst galaxies with SFRs as large as high-z galaxies are usually very dusty system (e.g. Luminous Infrared Galaxies, LIRGs) inconspicuous in the far-UV, while the extinction in typical high-z star forming galaxies (e.g. Lyman Break Galaxies, LBGs) is much lower. Local blue dwarf galaxies have low extinction, but generally also have masses and SFRs much lower than LBGs. Studying Lyman Break Analog (LBAs), relatively nearby starburst galaxies that share the typical characteristic of LBGs, can shed light to this problem. The striking similarities between LBAs and high redshift galaxies allow us to probe a unique angle in studying the relation between the HI gas mass fraction and the ability to form stars in a class of starburst galaxies not studied before. We use GMRT data of six LBAs that have redshift range from 0.1 0.2 and try to measure the HI gas contents in this galaxies. From the radio data we will derive the HI line flux and measure how much the HI gas contents and try to relate this property with galaxy‘s characteristic such as SFR, mass, morphology, dust, and metallicity.

The HI super profiles of the THINGS galaxies

R. Ianjamasimanana (University of Cape Town) & E. de Blok (University of Cape Town)

We present a novel method to study the relationship between gas content of galaxies, their star formation activity and the phase structure of the ISM. We do this by summing all individual profiles in the data cubes of the THINGS samples. We find that the shapes of these so-called "super profiles" depend on the star formation activity of the galaxies. The super profiles tend be broader and more asymmetric in high SFR area. This probably due to injection of kinetic energy by young massive stars which drive non-circular gas motion. By decomposing the super profiles into Gaussian components, we find strong evidence of the presence of the CNM/WNM in all the THINGS galaxies. The presence of these two components are indicated by the presence of narrow and broad HI components. There is also a correlation between the CNM and the star formation activity of galaxies. The CNM dominate in high SFR regions. This reflects the importance of the CNM for the process of star formation.

Luminous satellites in lenses

S. Bryan (University of Manchester), S. Mao (University of Manchester) & S. Kay (University of Manchester)

Substructures, expected in cold dark matter haloes, have been proposed to explain the anomalous fux ratios in gravitational lenses. About 50 per cent of lenses in the Cosmic Lens All-Sky Survey (CLASS) appear to have luminous satellites within about $5h^{-1}$ kpc of the main lensing galaxies, which are usually at redshift z $\sim$ 0.2 â 1. We have used the Millennium Simulation combined with galaxy catalogues from semi-analytical techniques to study the predicted frequency of such satellites in simulated haloes. The fraction of haloes that host bright satellites within the (projected) central regions is similar for red and blue hosts and is found to increase as a function of host halo mass and redshift. The fraction found in the simulated galaxies are lower than the fraction ($\sim$ 50 per cent) of CLASS lensing galaxies observed to host luminous satellites. Also, most of the satellites found in the inner regions are âorphanâ galaxies where the dark matter haloes have been completely stripped. Thus, the results crucially depend on the true survival rate of these âorphanâ galaxies. We have also considered the effects of numerical resolution and different cosmologies on our results.

Observing Molecules in Luminous Infrared Galaxies

F. Costagliola (Onsala Space Observatory)

Luminous infrared galaxies (LIRGs) emit most of their radiation in the infrared region of the spectrum in the form of dust thermal continuum, with typical luminosities of $L_{\rm IR}$ $>10^{10}$ $L_{\odot}$. The central power source responsible for the total energy output is deeply buried in the dusty central regions of these objects and its origin still unclear. Recent studies suggest that some LIRGs might represent early obscured stages of active galaxies, either active galactic nuclei (AGN) or starbursts, and thus play a fundamental role in galaxy formation and evolution. Molecular emission lines at mm wavelengths are routinely used to derive physical properties of the interstellar medium (ISM), such as temperature and density, both in Galactic and extragalactic objects. Chemical models reveal that in extreme environments, such as radiation-dominated regions, the relative abundance and excitation of different molecular species depends on the spectral energy distribution of the impinging radiation field. A starburst (UV-dominated) or and AGN (X-ray dominated) should thus leave different chemical signatures in the ISM, that can be revealed by mm observations. Because of this, molecules have been used, by many research groups, as indirect probes of the inner power source of LIRGs. Here I will give a short overview of the main molecular tracers and diagnostic methods, together with highlights from my own research.

Global correlations in Galaxies

M. I. Rodríguez (Instituto de Astrofísica de Andalucía), F. Costagliola, S. Aalto, A. Alberdi, & M. A. Pérez-Torres

The analysis of various correlations among the global far-infrared (FIR), radio-continuum (RC) CO, and HCN luminosities for a sample of 23 galaxies will be presented.

Structure and Dynamics of Giant Low Surface Brightness Galaxies

F. Lelli (Kapteyn Astronomical Institute), F. Fraternali (Department of Astronomy, University of Bologna) & R. Sancisi (INAF, Astronomical Observatory of Bologna)

Giant low surface brightness (GLSB) galaxies are commonly thought to be massive, dark matter dominated systems. However, this conclusion is based on highly uncertain rotation curves. We present here a new study of two prototypical GLSB galaxies: Malin 1 and NGC 7589. We re-analysed existing HI observations and derived new rotation curves, which were used to investigate the distributions of luminous and dark matter in these galaxies. In contrast to previous findings, the rotation curves of both galaxies show a steep rise in the central parts, typical of high surface brightness (HSB) systems. Mass decompositions with a dark matter halo show that baryons may dominate the dynamics of the inner regions. Indeed, a "maximum disk" fit gives stellar mass-to-light ratios in the range of values typically found for HSB galaxies. These results, together with other recent studies, suggest that GLSB galaxies are systems with a double structure: an inner HSB early-type spiral galaxy and an outer extended LSB disk. We also tested the predictions of MOND: the rotation curve of NGC 7589 is reproduced well, whereas Malin 1 represents a challenging test for the theory.

Low frequency observations of diffuse radio emission in galaxy clusters

G. Macario (INAF-IRA), T. Venturi (INAF-IRA), G. Brunetti (INAF-IRA), D. Dallacasa (INAF-IRA), S. Giacintucci (CfA) & M. Markevitch (CfA)

A fraction of merging galaxy clusters is known to host diffuse radio emission extended on the Mpc–scale, usually classified as radio halos and radio relics. These sources have typical steep synchrotron spectra ($\alpha \gtrsim 1$, $S \propto \nu^{-\alpha}$). Low frequency observations are thus well suited to study such steep spectrum radio emission, and to shed light on the scenarios proposed for their origin. In this context I will present results for two clusters: 1) A spectral study of the radio halo in A697, carried out by means of GMRT 325 MHz and VLA 1.4 GHz observations. We found that the total spectrum of the radio halo is very steep, i.e. $\alpha\,^{1.4\mathrm{GHz}}_{325\mathrm{MHz}} \approx 1.7 - 1.8.$ ± 0.1, which provides further support to the turbulence re–acceleration scenario for the origin of cluster radio halos. 2) A radio/X–ray study of the merging cluster Abell 754, known to host a central radio halo. For this cluster our radio (GMRT at 325 MHz) and X-ray (deep Chandra ACIS-I) data show that the radio halo has an edge of emission coincident with a merger shock front (Mach$\sim$1.5). The origin of this feature may be associated to the shock.

Abstracts of poster contributions

Design and Performance of ALMA Band 5 Receiver Components

B. Billade (Chalmers University of Technology), I. Lapkin, O. Nystöm, E. Sundin, M. Fredrixon, M. Strandberg, D. Meledin, S.E. Ferm, H. Rashid, V. Desmaris, D. Dochev, G. Johnsen, A. Pavolotsky & V. Belitsky

We present the details on design and performance of the key components of the ALMA Band 5 prototype receiver cartridge, covering RF frequencies from 163 - 211 GHz and intermediate frequency (IF) from 4 - 8 GHz. Measurements of the 2SB mixer configuration indicated noise temperature below 65 K (7.5hf/k) and sideband rejection better than 10 dB over 85% of the band.

Formation of dense cores by fragmentation of velocity-coherent, subsonic filaments in L1517

A. Hacar (Observatorio Astronómico Nacional) & M. Tafalla (Observatorio Astronómico Nacional)

We present observations of the Taurus dark cloud L1517 in a number of tracers sensitive to both the dense cores and the material surrounding them. The goal of this project is to study the transition from the extended gas regime to the dense cores. The extended gas consists of 4 filamentary-like structures with sizes typically 0.5 pc and masses close to 10 $M_\odot$. These filaments are axially concentrated, and present density profiles that are reasonably well fitted by an isothermal ("Ostriker filament") solution at 10 K and with central densities close to 10^4 cm^{-3}. The gas in the filaments is strongly subsonic and velocity coherent: its linewidth is typically 0.6 c_s over the whole 0.5 pc length. In addition, the mean gas velocity varies by at most the sound speed from end to end of the filaments. The velocity field of the gas in the cores is very similar to that in the filaments, and this suggest that the cloud-to-core transition occurs without appreciable kinematic changes. We can rule out in particular that the cores form from the direct collision of gas flows inside the filaments. We propose that the cores form from the fragmentation of subsonic, velocity-coherent gas. Although gravitational fragmentation seems appealing, the typical distance between cores is about half that predicted by models of perfect, infinitely-long filaments. Pre-existing density enhancements in the filaments may explain the closer packing of cores observed.

Pulsar Astronomy with LOFAR

T. Hassall (University of Manchester) B. Stappers (University of Manchester), A. Alexov (ASTRON), A. Askegar (ASTRON), T. Coenen (Universiteit van Amsterdam), J. Hessels (ASTRON), A. Karastergiou (University of Oxford), V. Kondratiev (ASTRON), M. Kramer (Max-Planck-Institut fÃ¼r Radioastronomie), J. Van Leeuwen (ASTRON), & A. Noutsos (Max-Planck-Institut fÃ¼r Radioastronomie.)

The LOw Frequency ARray (LOFAR) is an exciting new telescope for pulsar astronomy. Its large bandwidth and high sensitivity at frequencies below 200 MHz will open up a relatively unexplored spectral window, which could shed new light on pulsar population estimates, emission mechanisms and the pulsar luminosity function. Studies of pulsars will also provide interesting information on the Interstallar Medium through scattering and polarization studies and the planned all sky survey will uncover hundreds of new weak, nearby pulsars. In this poster I will present some of the early science and comissioning milestones of the Pulsar Working Group.

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