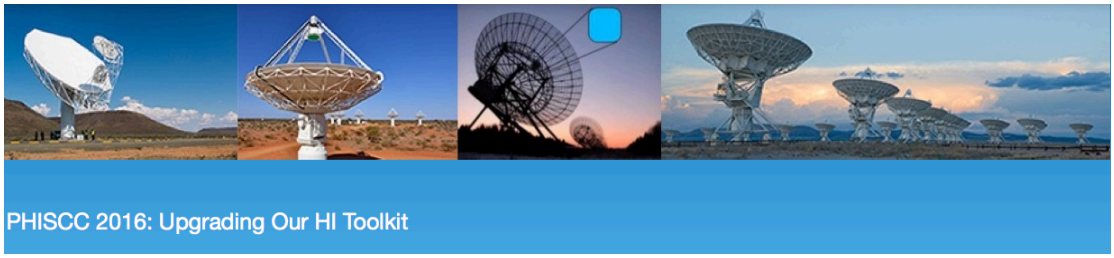

PHISCC 2016: ABSTRACTS

Monday 1 February
Willem Esterhuyse: MeerKAT Update
I will present a short overview of MeerKAT construction status and timelines to completion of the various array releases. including the science capability of the instrument associated with the various array releases.
Sharmila Goedhart & Tom Mauch: MeerKAT spectral line commissioning & pipeline update
MeerKAT Array Release 1 commissioning will start in January 2015. We shall provide a report on the status of MeerKAT commissioning and discuss the spectral line and pipeline commissioning plan.
Ian Heywood: ASKAP Update
I will present an overview of recent developments in the Australian Square Kilometre Array Pathfinder (ASKAP) project. The focus has shifted from the use of the Mk.1 phased array feeds on the 6-element BETA prototype to a staged deployment of Mk.2 feeds across the full ASKAP array. Compared to BETA, the Mk.2 system has a four-fold increase in the number of simultaneous beams, and a system temperature that is a factor >2 better in the region of the spectrum used to detect neutral hydrogen emission. ASKAP's Early Science program will be conducted with a 12-element Mk.2 array, commencing mid-2016.
Tom Oosterloo: APERTIF Update
While we are enjoying the PHISCC, the first commissioning of Apertif will be in full swing. I will give an update on the progress of this process. In recent months, the final outline of the Apertif surveys has been defined, a process I will describe and explain.
D.J. Pisano: CHILES Update
The COSMOS HI Large Extragalactic Survey (CHILES) is an ongoing 1002 hour project to observe HI from z=0 to 0.45 in the COSMOS field using the Jansky Very Large Array in B configuration. In addition to the HI survey, there are two commensal surveys: CHILES Con Pol (a full polarization deep continuum survey) and CHILES VERDES (a transient survey). Observations for the survey are now 40% complete, but the spectral line data reduction is lagging behind due to the complexity and challenges of working with such large amounts of data. I will discuss the current state of the CHILES data reduction pipeline and the lessons that are applicable for future surveys such as LADUMA and DINGO.
Erwin de Blok: MHONGOOSE, the MeerKAT Nearby Galaxy Survey
I will give an overview of MHONGOOSE, the MeerKAT Nearby Galaxy Survey, with an emphasis on the sample selection and early science results obtained with KAT-7. In addition I will discuss some of the issues associated with software and data reduction that will be important for attaining the required sensitivity.
Bradley Frank: Preparation for the MeerKAT HI Survey of Fornax
The MeerKAT HI Survey of Fornax will allow us to achieve an sensitive and unprecedented view of the life-cycle of gas in cluster galaxies providing us with insights into the assembly of the Fornax cluster and a deeper understanding of how the majority of galaxies in the universe

acquire gas and evolve. This tremendous opportunity also presents considerable challenges - many of which are shared with other MeerKAT large imaging surveys. Some, however, are unique to our science case. The challenge of imaging in the presence of the bright emission from the radio lobes and Fornax A is of particular importance to us. This translates into strict requirements for bandpass stability and high dynamic range imaging, which will invariably require direction dependent calibration. Additionally, our sensitivity to low column density neutral gas, in combination with the high spatial resolution and wide survey area will necessitate accurate imaging and joint deconvolution, which presents performance demands. Finally, we will also be faced with the challenge of how to efficiently store and archive the data. In my talk I will outline the progress we have made in formally defining the technical requirements in relation to the aforementioned challenges. I will also provide a brief review of our science goals and the preparations that we are making for science delivery.

Lister Staveley-Smith: Wallaby overview

I will give an overview of recent results from Wallaby BETA and planning activities for Early Wallaby with ASKAP-12. Wallaby team members have invested substantial effort in building capability for the execution and scientific analysis of the survey. This effort includes software tools for source recognition and parameterisation, software platforms, dataflow and VO infrastructure, simulations, and close collaboration with complementary continuum, optical/IR imaging and spectroscopic surveys, as well as matching northern HI surveys. As the early Wallaby start date approaches, future efforts will shift to matters of implementation and optimisation, with additional effort going into data intensive middleware, quality assurance and visualisation.

Attila Popping: A survey update on DINGO

I will give an update on preparations for DINGO, the deep neutral hydrogen survey on ASKAP. To test the reduction and analysis tools that will be required for DINGO, we have started several precursor projects on existing telescopes such as the JVLA. I will discuss recent progress on these projects and outline our plans for the early science phase of ASKAP.

Benne W. Holwerda: The LADUMA survey, the deepest HI field; current status

To trace the fueling of galaxies over the last 7 Gyr of the age of the Universe, we proposed the deepest integration with a radio telescope to date. The LADUMA survey was chosen as one of two priority group 1 large surveys for the MeerKAT radio telescope, South Africa's 64-dish pathfinder instrument for the SKA now under construction in the Karoo. Starting operations in the end of 2017, it will observe a field encompassing the Extended Chandra Deep Field South to detect HI emission from a Milky Way gas-mass out to z~1.4 (7 Gyr ago) Complementary observations are expected to include spectroscopy with the AAT and ESO's 4MOST multi-object spectroscopy instruments, LSST & EUCLID deep imaging and targeted follow-up with SALT and ALMA, aside from an already existing wealth of multi-wavelength data (Chandra, HST Spitzer, Herschel, & ground-based). LADUMA science topics include evolution of the HI mass function, the cosmic hydrogen density (Omega-HI), stellar- and halo-mass gas-fractions, and the evolution of the Tully-Fisher relation. All these topics and more fall under the general heading of the fueling and evolution of galaxies. Given the current foreseen roll-out of SKA capabilities, the depth and redshift range of the LADUMA HI data-cube is going to be unsurpassed until SKA-2 comes online (late 2020s). I will discuss survey status, team preparations and plans for HI and ancillary data collection and collation.

Natasha Maddox: Commensal observing: HI science from continuum surveys

Observing commensally enhances the scientific return of a set of observations without significant additional overhead. While LADUMA is the primary high redshift HI survey planned with MeerKAT, valuable spectral line data will be collected by the extragalactic continuum survey MIGHTEE. We explore the complementarity of the two surveys, which are well paired in terms of volume and depth, and investigate the enhanced science enabled by the combined LADUMA+MIGHTEE dataset. We then extend the idea to optimising the HI and continuum surveys to be undertaken with the SKA1-MID instrument.

Marc Verheijen: APERTIF SURVEYS

A short overview will be given of the surveys that are planned for Apertif, comprising a shallow (1x12hr) imaging survey of ~3500 deg^2, a medium-deep (Nx12hr) imaging survey of ~350 deg^2, and a pulsar and transients survey of ~15.000 deg^2. Several specific LOFAR fields of interest will be imaged (4x12hr) with Apertif as well. The imaging survey areas, depths and resolutions will be discussed briefly, as well as the developing plans for their scientific exploitation.

Kelley Hess: First science with CHILES

The ongoing CHILES survey is a technological and scientific pathfinder for upcoming surveys with the SKA pathfinder telescopes. The first ~450 hours of CHILES have been observed with the JVLA and cover an unprecedented range in HI redshift from z=0 to z=0.5. I will present the first results from both direct detections and stacking experiments. In combination with multi-wavelength data available from COSMOS, and our own ancillary observations, we are learning about the atomic gas properties of galaxies at the reaches of the HI imaging window available to date.

James Allison: The ASKAP First Large Absorption Survey in HI

In the pre-SKA era, 21-cm absorption from the cold neutral medium is a vital tool for carrying out a census of the star-forming gas at redshifts not easily obtainable in HI emission or Lyman-alpha absorption. ASKAP will allow astronomers to carry out the first radio-selected survey for HI 21-cm absorption over the entire southern sky, at redshifts between 0 and 1. For the first time we will obtain robust statistics on the cold hydrogen gas in distant galaxies from detections of several thousand intervening and associated systems, free of the problems associated with prior selection based on optical wavelengths. Over the past year we have carried out a pilot survey of more than 100 radio sources with the Boolardy Engineering Test Array (BETA), achieving our first detections of new systems and demonstrating that such a wide-band survey is feasible at the site. I will discuss some of these new results and the methodologies we have developed for dealing with the large volumes of data processing and interpretation in the context of the upcoming FLASH.

Neeraj Gupta: MALS Update

The MeerKAT Absorption Line Survey (MALS) is one of the ten large surveys to be carried out with the MeerKAT telescope. The main objective of the survey is to carry out a sensitive blind search for HI 21-cm and OH absorption lines, and trace the evolution of cold atomic and molecular gas in galaxies at z<1.5. A dust-unbiased sample of bright (>200 mJy at 1 GHz) radio loud quasars (RLQs) at z>1.5 is required to achieve this and build a comprehensive picture of ISM and its relationship with the ongoing star-formation in galaxies. In this talk, I will present early results from our campaign with SALT to build the IR selected quasars at high-z and other ongoing programs in preparation for MALS.

Martin Meyer: SKA HI Science Working Group Update

Tuesday 2 February

Thijs van der Hulst: Visualisation in Spectral Line Astronomy

Visualisation software for astronomical data has been around since the 1970's. The variety and amount of data has however undergone a staggering growth, which continues into the future. Astronomical visualisation tools have barely kept up with this growth while the need for effective visualisation tools increases. This presentation will focus on the visualisation needs for radio spectral line data, review its requirements and provide an overview of existing tools and current developments.

Russ Taylor: Visual Analytics of Remote Big Data in Radio Astronomy

The size of image data sets being created by SKA pathfinders and eventually by the SKA itself means that traditional desktop visualization solutions will no longer be feasible. New approaches and technologies are required to allow visualization and visual analytics of remote big data. Moreover new modalities of data interaction are required that fuse data from multiple sources and wavelengths, and new tools for collaborative visualization of the same big data by globally distributed research teams. A prototype big data visual analytics tool has

been developed within the cyberSKA data intensive research portal and is being use for global collaborations around data sets from SKA pathfinder projects with the JVLA, GMRT and Arecibo telescopes.
In collaboration with the National Radio Astronomy Observatory, the University of Alberta and the SKA SA project we are developing a next-generation visualization system that builds upon the cyberSKA remote data viewer - the Cube Analysis and Rendering Tool for Astronomy (CARTA). CARTA is being designed to meet the visualization specifications and use cases for data sets produced by the Atacama Large Millimetre/Submillimetre Array, the JVLA and MeerKAT. The core architectural features of CARTA include: a) an extensible framework through a plugin infrastructure, b) server-side visualization interfaced to a web-based user client, c) an indistinguishable desktop application based on the same code-base and d) a python-based scripting interface to control the visualization engine.
An alpha version of CARTA is available through the cyberSKA portal. The portal provides an on-line space for distributed teams to collaborate around data sets that are too large for desktop astronomy. I will provide a project update and demonstration of the cyberSKA viewer and CARTA.

Davide Punzo: SlicerAstro, a 3-D interactive viewer

At PHISCC 2015, we reviewed the visualization challenges of large field of view blind HI surveys such as planned for APERTIF and ASKAP. We demonstrated the advantages of adopting interactive 3-D visualization of HI data for the following applications: i) very fast inspection of the data, e.g. immediate overview of the HI morphology and kinematics of a galaxy; ii) discovery of very faint signal which is coherent in three dimensions such as tails and extended filaments between galaxies; iii) interactive coupling to modeling to provide additional capabilities for the discovery of subtle structures, e.g. extra-planar gas, in the 3-D domain. We are developing a fully interactive visualization tool: SlicerAstro, an extension of 3-DSlicer (http://www.slicer.org), a state-of-the-art medical visualization and analysis package. SlicerAstro will be capable of handling astronomical coordinate systems, allow coupled 3-D/2-D/1-D visualization, interactive filtering and supervised 3-D modeling. We will give an overview of the current status of the project. SlicerAstro repo: https://github.com/Punzo/SlicerAstro

Lourdes Verdes-Montenegro: The X3D path applied to disentangling the HI component in Compact Groups of galaxies

As an extreme kind of environments, Hickson Compact groups (HCGs) have shown to be very complex systems, particularly when seen through the HI line. HI-VLA observations revealed an intrincated network of HI tails and bridges, tracing pre-processing through extreme tidal interactions. CGs seem to be evolving from a phase where the gas is located in the galaxy disks, to intermediate cases where the HI is mostly found in the intragroup medium, and finally into a stage where almost no HI is detected (Verdes-Montenegro et al 2001). Furthermore, comparison of VLA imaging with high-quality observations with the GBT (Borthakur et al 2010, 2014) has provided evidence for the existence of a diffuse HI component missed by the VLA that increases with evolutionary stage, more consistent with tidal stripping than with ram-pressure (Rasmussen et al 2008), spread over a velocity range of more than 1000 km/s. This suggests that slow evolution of tidal debris may lead to a final stage where the HI becomes faint and extended – hence escaping detection by current interferometers – being returned to the IGM. In summary, the complex net of detected HI seems so puzzling as the missing one. MeerKAT and SKA-MID will provide the required field of view with a highly improved sensitivity able to provide key information on the fate of gas in HCGs. Till SKA1 starts observations, further progress can be made through a) studies at complementary wavelengths (e.g. Tzanavaris et al 2010, Cluver et al 2013, Alatalo et al 2014), b) preparatory work through pathfinders, and c) advanced visualization techniques that allow improving significantly the insight into as complex datasets as the HI cubes of these strongly interacting systems. In this talk we will show how the X3D pathway (Vogt et al 2015) constitutes both a powerful tool to extract the most from HI data cubes and as a mean of simplifying and easing the access to data visualization and publication via three-dimensional (3-D) diagrams. The X3D pathway exploits the facts that 1) the X3D 3-D file format lies at the center of a product tree that includes interactive HTML documents, 3-D printing, and high-end animations, and 2) all high-impact-factor & peer-reviewed journals in Astrophysics are now published (some exclusively) online. We argue that the X3D standards

(http://www.web3d.org/standards) are an ideal vector for sharing multi-dimensional datasets, as it provides direct access to a range of different data visualization techniques, is fully-open source, and is a well defined ISO standard. The interactive HTML branch of the X3D pathway is also actively supported by leading peer-reviewed journals in the field of Astrophysics. The existing information on the HI distribution and kinematics of HCGs will be here revisited by means of X3D visualization.

J.T. Malarecki: Organisation and Exploration of Very Large Imagery Data in the SKA

The volume of data that modern and upcoming radio telescopes are expected to produce introduces technical and methodological challenges that may hinder the effective exploration of such data. Visualisation tools are very important in helping researchers to understand their data. Technology should enable interactive data exploration, however this is commonly achieved by reducing the data to manageable volumes. Data exploration strategies will need to evolve alongside the advances in measurement instruments in order to utilise the wealth of new information. The aim of this research is to aid effective exploration of large-scale datasets to complement analysis. I will present my progress in organising data to better suit the requirements for effective exploration: optimising the JPEG2000 format for astronomical data, and utilising compression and fidelity to enhance visual exploration. I will also discuss my work towards visualising large volumes of data.

Tobias Westmeier: 3-D source-finding challenges in the era of big data

Future HI surveys with ASKAP, MeerKAT and ultimately the SKA will produce data cubes of unprecedented size. Extracting the large number of galaxies expected to be detected by these surveys will require sophisticated and fully automated source finding algorithms. In my talk I will review the current status of SoFiA, the new HI source finding pipeline created by our international HI source finding collaboration. After introducing some of the latest features of the pipeline, I will discuss the remaining challenges in getting SoFiA ready for the fast approaching era of big data.

Nadine Giese: Non-parametric characterization of HI in galaxies

One of the challenges for future large HI surveys will be the characterization of the large number of objects that are expected to be detected in the data. Detailed model fitting of the HI morphologies and kinematics will be possible only for a small fraction of the objects. For the majority of the galaxies, faster, automatic and sensitive methods are required for a robust and scientifically useful classification of the full 3D morphologies. We have investigated a set of parameters which have been used successfully on galaxies from optical surveys to separate regular from non-regular objects. We will show the limitations of these parameters as well as their dependence on data quality and present a more robust way to use in particular the Asymmetry parameter to describe the morphology of galaxies detected in HI. We applied this improved method on the WHISP and Atlas3D samples to investigate the relationship between the environment of galaxies and their measured asymmetries and will discuss these first results.

Toby Brown: HI Stacking and the Effect of Environment on Gas Content

The importance of cold gas in the picture of galaxy evolution is well known, as is its role as a probe of recent environmental effects on galaxies in the nearby universe. However, sensitivity limitations mean the extent to which environment impacts the gas cycle of galaxies remains unclear. With this poster we show how we take full advantage of the powerful HI spectral stacking technique to overcome this obstacle and quantify the gas content for the entire gas-poor to -rich regime. To do so, we use an unparalleled multi-wavelength sample of 28,000 nearby galaxies, selected according to stellar mass and redshift from the Sloan Digital Sky Survey, with atomic hydrogen (HI) data from the ALFALFA survey and halo masses from the Yang et al. 2007 Group Catalogue. We present HI scaling relations with key structural, star formation and environmental metrics, using stacking to provide strong observational evidence of significant and systematic environment driven gas suppression across the group regime, well before galaxies enter the cluster. This enables us to give constraints on galaxy formation and evolution models by disentangling the influence of environment on gas content. Finally, we show how the stacking method may be applied to future HI surveys with the SKA and its pathfinders, delivering much larger samples of objects across a large range of redshifts.

Barbara Catinella: Galaxy evolution with HI spectral stacking

Spectral stacking is a powerful technique to gain insights into the statistical properties of a population of galaxies that lack individual detections in a survey. Indeed, the upcoming SKA precursor HI surveys will allow us to detect HI emission beyond z~0.2, but the most stringent constraints on the HI content of galaxies across cosmic time will come from stacking of undetected sources. I will discuss recent work based on spectral stacking of the largest stellar mass-selected sample with HI data assembled to date, which demonstrates the usefulness of this technique for galaxy evolution studies, as a means to investigate the connection between gas, star formation rate and other galaxy properties across environments and cosmic time.

Julia Healy: HI Stacking: Software and Applications

Due to the intrinsic faintness of the HI emission line, galaxies more distant than a few hundred Mpc cannot be directly imaged at radio wavelengths within a reasonable amount of time. The solution is to co-add the emission from distant galaxy samples in order to generate a statistically meaningful measure of the total HI mass content. In advance of the upcoming large SKA pathfinder surveys such as LADUMA, which will observe neutral hydrogen in galaxies to higher redshifts than ever before, we aim with this project to develop a python-based software package that will stack HI spectra for samples of distant galaxies in a reliable and consistent manner. The package will be released to the broader astronomy community. Also presented are preliminary results from a stacking analysis of HI spectra from undetected sources from the Nancay Interstellar Baryons Legacy Extragalactic Survey.

Kristine Spekkens: Measuring disk galaxy kinematics from future HI surveys

HI surveys with SKA precursors are expected to resolve the HI distributions of thousands of nearby galaxies to varying degrees, affording some of the first statistical investigaions of their mass and angular momentum distributions. I will provide an update on the activities of the Wallaby kinematics group, tasked with developing the pipeline that will measure the kinematical properties of resolved detections from that survey. In particular, I will describe the conceptual pipeline that we have developed, what we have learned about automatically fitting galaxy kinematics using 2D and 3D techniques, alternative modelling techniques that have emerged in recent months, and the challenges to delivering the pipeline that remain. Our lessons learned can be readily applied to any survey aiming to measure disk galaxy kinematics in the marginally- to moderately-resolved regime.

Se-Heon Oh: 2D Bayesian Automated Tilted-ring Fitter (2DBAT)

We present a newly developed algorithm based on a Bayesian method for 2D tilted-ring analysis of disk galaxies which operates on velocity fields. Compared to the conventional ones based on a chi-squared minimisation procedure, this new Bayesian-based algorithm less suffers from local minima of the model parameters even with high multi-modality of their posterior distributions. Moreover, the Bayesian analysis implemented via Markov Chain Monte Carlo (MCMC) sampling only requires broad ranges of posterior distributions of the parameters, which makes the fitting procedure fully automated. This feature is essential for performing kinematic analysis of an unprecedented number of resolved galaxies from the upcoming Square Kilometre Array (SKA) pathfinders' galaxy surveys. A standalone code, the so-called “2D Bayesian Automated Tilted-ring fitter” (2DBAT) that implements the Bayesian fits of 2D tilted-ring models is developed for deriving rotation curves of galaxies that are at least marginally resolved (> 3 beams across the semi-major axis) and moderately inclined (20 to 70 degree). The details of the main layout of 2DBAT and its performance test are discussed using sample galaxies from AustraliaTelescope Compact Array (ATCA) observations as well as artificial data cubes built based on representative rotation curves of intermediate-mass and massive spiral galaxies.

Gyula Jozsa: Fully Automated TiRiFiC

With the upcoming wide field HI surveys, the angular momentum distribution of the cool gas in a large number of galaxies gets observed, hence giving us access to a formerly unavailable richness of information - provided that we have the required analysis tools at our hands. I will discuss the pipeline FAT (Fully Automated TiRiFiC), a tool that aims at extracting this information automatically from data cubes.

Toky Randriamampandry: Accounting for non-circular motion in barredspiral galaxies

The observed velocities of gas in barred spiral galaxies are a combination of the azimuthally-averaged circular velocities and non-circular streaming motions. It is important to account for these non-circular motions when using the gas rotation curve to construct mass models of galaxies. Using numerical simulations, we show that the commonly used method of determining the rotation curve of a galaxy (the so called tilted-ring method) can significantly under/over estimate the circular velocity depending on the bar orientation. We present a new correction method based on N-body simulations, and apply the method to the test case of NGC 3319.

Martin Zwaan: Tools for measuring galaxy space densities from HI surveys

A fundamental challenge for all 21cm surveys is the accurate determination of space densities of detected objects. Key science goals such as the measurement of the cosmic gas mass density, the evolution of the shape of the HI mass function and its dependence on environment, and the velocity function are critically dependent on unbiased number density estimators. Therefore, developing the tools that convert the HI source catalogues into space densities should be a priority. I will discuss different statistical approaches to measuring space densities (e.g, the 1/Vmax, 2DSWML, C-, and phi/Phi estimators) and using simulations, I evaluate the strengths and limitations of their application to planned HI pathfinder survey results. Robustness against the effects of large scale structure (LSS) is of crucial importance. As an illustration, I will demonstrate that a careful treatment of LSS effects alleviates the tension between the HIPASS and ALFALFA HI mass functions.

Oleg Smirnov: 3C147 & CygA & friends: high dynamic range imaging and the software ecosystem

I will discuss some recent results in high dynamic range imaging using JVLA data, in particular the 5M DR images of 3C147 (and preliminary 7M DR results with BnA observations). These were achieved by incorporating a primary beam model into the calibration pipeline, and combining that with differential gain calibration. I will show some surprising holographic measurements of the JVLA beam. I will also show some world record S-band images of CygA from JVLA A+B+C configuration, and discuss deconvolution challenges. Finally, I'll give an overview of new algorithmic developments in the calibration & imaging field.

Jan-Willem Steeb: Spatial Filtering of Radio Frequency Interference

The recovery of KAT-7 visibility data from RFI corruption using spatial filtering, which makes use of orthogonal projectors and bias correction, is presented (method originally published in [1]). The method requires that the integration time for the visibility data be broken up into short term integration times. The short term integration time visibilities are packed into a covariance matrix which undergoes factor analysis to detect the RFI's spatial signature. Consequently, an orthogonal projector is constructed from the RFI's spatial signature, which nulls the RFI. However, the process also biases the instrumental noise and cosmic signals. If the assumption holds that the RFI is not stationary between subsequent short integration times, a matrix can be constructed from all the short term integration time projectors. Since the RFI spatially varies the matrix can be inverted and applied to the average of the orthogonally projected short term integration time covariance matrices which recovers the cosmic signal as well as the instrumental noise. When this technique is applied to KAT-7 data, the mean absolute percentage error (MAPE) is attenuated by at least 16 dB to about 5%. The performance of the technique on KAT-7 data will be improved by conducting observations where the short term integration time is shortened and by narrowing the individual channel's bandwidth.

Wednesday 3 February

Chris Power: Galaxy Formation Modeling for the SKA and its Pathfinders

The treatment of cold gas in galaxy formation models and simulations has improved dramatically in the last 5 years, with notable advances in connecting star formation to neutral hydrogen. I will review these developments in brief before presenting recent work undertaken

by the computational theory and modeling group at ICRAR/UWA, including novel simulations work on how gas gets into galaxies; theoretical work on the relationship between halo mass, stellar mass, and HI mass; and a new fast approximate algorithm for modeling the large scale distribution of neutral hydrogen.

Charlotte Welker: Gas accretion onto galaxies: the imprint of the cosmic web

In this talk I will present in details the major features that govern the geometry and dynamics of the cold gas flows on extragalactic scales, and further develop the consequences of such anisotropic, angular momentum-rich inflows on galactic scales. In particular, I will explain how the dynamical and anisotropic nature of the cosmic web imprints the cold gas streams that are later accreted onto galaxies, and how it affects the satellite distribution, spin and morphology of galaxies over a wide range of redshifts. To perform this analysis, I will rely on both insights from lagrangian theory and recent results drawn from the analysis of the 100Mpc box « full-physics » hydrodynamical cosmological simulation Horizon-AGN.

Romeel Dave: Hydrodynamic Simulations of HI Evolution in Galaxies

I will present predictions for the evolution of neutral hydrogen in galaxies across cosmic time and as a function of environment. I will describe some of the key outstanding questions in understanding the gas cycle in galaxies, and which predictions from simulations can be compared to existing or potential new observations in order to make progress. I will describe our ongoing efforts to provide a user-friendly platform for enabling multi-wavelength comparisons of data and other models to our new suite of hydro simulations being run at UWC.

Daniel Cunnama: Mocking Astrophysics

Galaxy clusters are the most massive virialised structures in the Universe, and they provide a fascinating natural laboratory for testing theories of galaxy evolution. The recent “nIFTy Cosmology: Numerical Simulations for Large Surveys” workshop, held in Madrid between June 30th to 18th July 2014 and The Perth Simulated Galaxy Cluster Comparison workshop (March 23-27 2015), brought together experts from around the world to carry out cosmological simulations of a single galaxy cluster using a range of state-of-the-art codes — including GADGET and Arepo — and to compare the properties of gas and dark matter in the simulated cluster. A wide range of projects drawing on these data were initiated, including:
– Reconstructing the dynamical state and merging history of clusters from present-day observables
– Synthetic observations of galaxy clusters at radio continuum, X-ray wavelengths
– Weighing galaxy clusters via gravitational lensing, galaxy population kinematics, X-rays and joint statistical analyses
– Tidal disruption of galaxies in clusters, the formation of intra-cluster light
– The outskirts of clusters and the detection of missing baryons

Danail Obreschkow: Update on HI-driven angular momentum science

Starting with an overview on HI-assisted angular momentum science presented in the new SKA science case, I will highlight some recent advances in this field, as well as new prospects for ASKAP and MeerKAT. In particular, I will discuss (1) how HI data enables measurements of the angular momentum in dwarf galaxies, (2) why HI gas fractions are liked to the baryon angular momentum, and (3) how future HI data can be combined with IFU measurements to obtain optimal angular momentum estimates.

Ed Elson: A suite of new synthetic data products for the SKA precursors

At UCT we have been developing the theoretical and computational machinery to produce large synthetic data products for the forthcoming large galaxy surveys. Specifically, we are able to use state-the-art galaxy formation models to produce mock data cubes containing realistic HI line and radio continuum emission from millions of galaxies from z=0 to well beyond z=1. These cubes are arguably the best available approximations of what will be the data from the SKA precursors. They can be used to carry out mock experiments that allow us to develop and refine survey strategies, data handling and analysis methods, source finders, etcetera.
In this talk I will present the details of some of the methods we use to generate these

synthetic cubes. I will provide some examples of MeerKAT-like observations of the distant Universe. I will also present the results of an HI stacking study we have carried out using the cubes, the results of which suggest that existing Omega_HI measurements for of z<0.5 may well be significantly over-estimated. I will show further that LADUMA HI stacking experiments will yield accurate measures of Omega_HI at z=0.5 -1 and beyond.

Sphesihle Makhathini: HI-Inator: A tool for platform independent radio telescope simulations

We introduce HI-Inator, a compute platform independent radio interferometer simulation tool aimed at handling large data cubes. HI-Inator simulates visibility data from multi-frequency FITS files for a variety modern and upcoming radio telescopes, including MeerKAT, JVLA, WSRT and SKA1-MID. The tool also allows the addition of a parameterised sky model (Gaussians or point sources), as well as direction independent visibility corruptions. HI-Inator also uses Docker, which means it can be run from many platforms (laptop, cloud, cluster) with minimal effort. This tool was created in light of the planned spectral line surveys with modern and upcoming instruments so that i) we can quantify the effects of instrumental gains on the observed signal, and ii) establish a framework for robust tests of data reduction and analysis applications.

Mattia Vaccari: HELP-ing HI Surveys: The Herschel Extragalactic Legacy Project

The Herschel Extragalactic Legacy Project (HELP, http://herschel.sussex.ac.uk/) is a 4-year (2014-2017) 2.5 MEuro project funded by the EC FP7-SPACE programme whose aim is to produce homogeneous multi-wavelength value-added source catalogs spanning Herschel's wide-area extragalactic surveys for a total ~1000 deg^2. Building upon existing data reduction best practices at different wavelengths and developing new tools to identify the most likely sources of far-infrared emission in Herschel confused maps, HELP will bridge the gap between COSMOS and SDSS and produce a multi-wavelength database enabling galaxy evolution and AGN feedback studies of the distant Universe over the largest scales as a function of redshift and galaxy local environment. This will provide an accessible resource for the astronomical community to mine for decades to come, a lasting legacy of many thousands of hours on space telescopes as well as thousands of nights on ground based telescopes, building a solid foundation for future space missions and ground-based observatory projects. In my talk I will introduce HELP, its main objectives and hardest challenges, report on its status and outline how it will benefit upcoming HI surveys.

Andrew Baker: Optical Spectroscopy for HI Surveys

The LADUMA (Looking At the Distant Universe with the MeerKAT Array) deep HI survey will extend its reach to distant and/or faint galaxy populations by stacking at the positions and redshifts of optically selected samples. Using an ongoing program of optical spectroscopy of the LADUMA field with AAT/AAOmega as an example, I will discuss some of the specific science questions that can be addressed with the combination of optical and MeerKAT HI data. These analyses will exploit optical spectra for more than just redshifts, and will include an assessment of the HI content of optical absorption-line systems - a key test for models of the evolving cosmic HI density.

Ximena Fernandez: Highest redshift neutral hydrogen image in emission: A CHILES detection of a starbursting spiral at z=0.376

Our current understanding of galaxy evolution still has many uncertainties associated with the details of accretion, processing, and removal of gas across cosmic time. The next generation of radio telescopes will image the neutral hydrogen in galaxies over large volumes at high redshifts, which will provide key insights into these processes. We are conducting the COSMOS HI Large Extragalactic Survey (CHILES) with the VLA, which is the first survey to simultaneously observe HI from z=0 to z=0.5. The full survey consists of 1002 hours of observing time, giving us the sensitivity to image HI in 300 galaxies in the COSMOS field. Here, we report the highest redshift HI detection to date, the LIRG COSMOS J100054.83+023126.2 at z=0.376 with the first 178 hours of CHILES data. While the optical image shows it to be a large undisturbed spiral, the HI distribution is very extended and offset from the optical center. In addition, we present follow-up LMT CO observations that reveal it to be gas-rich in molecular hydrogen. This is the first study of the HI and CO for a galaxy beyond the local Universe, which will enable us to start exploring the ISM of galaxies at

higher redshift.

Mpati Ramatsoku: Preparing for Apertif: A WSRT mosaic of a nearby rich galaxy cluster

As a pilot survey for the upcoming all-sky HI surveys, WNSHS and WALLABY, we conducted an HI line imaging survey of a nearby cluster behind the Galactic Plane with the Westerbork Synthesis Radio Telescope. While the cluster itself is interesting as being part of the Perseus-Pisces Supercluster, we decided to use this survey as a test case for (a) large area mosaicking (35 fields arranged in a hexagonal grid covering 9.6 sq.deg, a setup similar to that of a single AperTIF pointing); (b) pipeline reduction and calibration techniques in the presence of two bright continuum sources (4.0 and 0.9 Jy) in three of the fields; (c) handling and viewing of large data cubes (40GB); (d) testing source detection algorithms over a wide range of velocity (cz = 2400 - 16600 km/s) and varying noise characteristics; (e) automatic extraction of a source catalogue and atlas images for all sources. Having a good handle on all this is invaluable for the planning and preparation of the forthcoming HI surveys to be carried out with SKA precursor instruments. In this talk I will give an overview of the data reduction techniques used and lessons learned as well as present the first results of the survey.

Betsey Adams: Apertif Surveys and the Smallest Galaxies

A long-standing cosmological quandary is the mismatch between observations and simulations on the smallest scales, including discrepancies in the number of low mass galaxies and how their baryons are distributed compared to predictions from simulations. One promising approach is to search for low mass dark matter halos via their gaseous content. This has the advantage of selecting systems that have remained isolated (i.e., evolved passively) and is sensitive to galaxies that may not have efficiently converted gas into stars. In this talk, I briefly summarize results from the ALFALFA HI survey and targeted WSRT observations showing that this is a promising approach and, importantly, that observations with an interferometer can distinguish good candidates based on their HI alone. I will then discuss the upcoming Apertif surveys and highlight what we can expect for the science case of extremely low mass gas-rich galaxies.

Brenda Namumba: Survey of Southern Local Group Dwarf Galaxies

The structural information about galaxies can be obtained from HI measurements. The distribution of HI gas in dwarf irregular galaxies is very clumpy and irregularly distributed and is frequently more extended. The available HI data on dwarf irregular galaxies has been obtained mostly using arrays with higher resolution, meaning that we could be missing out on the extended low surface brightness emission. With the capabilities of KAT-7 angular resolution, we have selected a well-defined sample of 7 dwarf galaxies to detect the extended HI emission, which cannot be detected by other synthesis array such as VLA and ATCA. These observations will help us constrain the distribution, kinematics and physical conditions of the atomic gas which are relevant to answering questions related to star formation and galaxy evolution. The proposed thesis will also make a significant contribution to commissioning the HI capabilities of the MeerKAT.

Jamie Bok: Exploring galaxy evolution with HI profile asymmetries

Studies of the global HI profiles of galaxies conducted by various authors have found a significant number of profiles to be asymmetric. Furthermore, it has been shown that there is a link between asymmetric global HI profiles and lopsided HI gas distributions. A promising candidate for the cause of these asymmetries are mergers and tidal interactions, however further investigation into the cause/causes is necessary. As a pilot project for the upcoming LADUMA survey, the focus of my project is to maximize the amount of information we can extract from the global HI profiles of the galaxies at the larger redshifts where resolution is too poor for imaging. Using a sample of galaxies from the ALFALFA survey we plan to investigate the prevalence of HI profile asymmetries, explore possible mechanisms by which this asymmetry is formed, and thereby probe galaxy evolution. In my talk I will motivate our research, describe our sample selection, and discuss preliminary results.

Moses Mogotsi: MHONGOOSE Galaxies in other wavelengths and determining their kinematics

The MHONGOOSE precursor sample was derived from the SINGG H-alpha, R-band and UV surveys. A subsample of the MHONGOOSE galaxies was observed using the SparsePAK and WiFeS IFUs. Multiple emission lines were detected and the H-alpha kinematics of the galaxies in the sample were studied. I will present the multi-line observations of these galaxies, their kinematics and other analyses of the spectral lines. These will be useful as they will allow us to study the high resolution kinematics of the MHONGOOSE galaxies and their ISM properties. The kinematics of these galaxies were determined using DiskFit, ROTCUR and a model that assumes a linearly rising rotation curve with no turnover (3D Plane model). These techniques will be used to determine the kinematics of the large range of galaxies that will be observed with the SKA-precursors. I will compare the results of fitting velocity fields using these methods and discuss their effectiveness.

Amidou Sorgho: Observing 5 MHONGOOSE galaxies with KAT-7

We present the preliminary results from the KAT-7 observations of the first five galaxies of the MHONGOOSE (MeerKAT HI Observation of Nearby Galactic Objects: Observing Southern Emitters) sample. With a sensitivity of ~ 2e19 cm^-2, we were able to map the HI distribution of the galaxies well beyond their optical disks. A comparison of the present observations with the single-dish HIPASS (HI Parkes All-Sky Survey) survey is also presented.

Elizabeth Mahony: A search for HI absorption in the brightest southern radio galaxies

Detections of HI absorption in distant radio galaxies can provide a powerful tool in understanding the role that cold gas plays in the formation and evolution of radio-loud AGN. Using the ASKAP-BETA telescope we have searched for HI absorption against sources selected from the 2-Jansky sample; a sample of southern radio galaxies with flux densities above 2 Jy at 2.7 GHz and redshifts less than 0.7. Using the lowest frequency band of ASKAP we have searched for HI absorption in the frequency range 700 MHz - 1.0 GHz corresponding to the redshift range of 0.4-1.0. This provides a high-redshift analog to the work of Morganti et al. 2001, who searched for HI absorption in low-redshift 2 Jy sources, allowing us to investigate how the properties of cold gas in radio galaxies evolves from redshift 0 to 0.7. In this talk I will present early results from this survey including a new detection of HI absorption towards a powerful FRII radio galaxy at z=0.7. Results obtained from this pilot study will provide valuable insight into what we can expect to detect in the upcoming ASKAP, MeerKAT and AperTIF absorption line surveys.

Spencer Wolfe: Observing very low column density HI within the Local Group

The Local Group contains the large spiral galaxy M31, the Milky Way and the smaller spiral M33, with several dwarf and satellite galaxies as well. Thus, it is an excellent place to study galaxy interactions, the intergalactic medium and circumgalactic medium of galaxies in detail. I will present my research on mapping very faint HI with the Green Bank Telescope between the galaxies M31 and M33. Here, we find several clouds of HI with no apparent stars. We are still uncertain as to the origins of these objects or the role they have in the evolution of the Local Group. We have also observed other areas around M31 with the GBT and are conducting VLA observations of the brightest HI cloud we have detected. I will briefly summarize our current work and future plans.

Nickolas Pingel: A Phased Array Feed for the Green Bank Telescope

Phased array feeds (PAFs) for large single dish telescopes provide an increased field of view, which translates to increased survey speeds. By simultaneously synthesizing multiple far field beams on the sky, astronomers will be able to use the full available field of view on existing and soon-to-be commissioned instruments to study the radio sky much more efficiently than conventional single pixel feeds. However, the increase in survey efficiency also comes with a significant increase in the complexity of the signal processing required for calibration and imaging. I will present progress for the development of the Focal L-Band Array for the Green Bank Telescope (FLAG), a backend for the 19-dipole PAF to be mounted on the Green Bank Telescope (GBT) in late 2016. My presentation will focus on the beam forming algorithms to be used for spectral line mapping, pulsar, and transient science. Additionally, I will present spectra from January 2015 test observations of neutral hydrogen in the nearby galaxy, Leo A. These spectra are among the first to ever be produced from a PAF mounted on a large single dish.