REPORT ON THE RADIONET3 NETWORKING ACTIVITY

TITLE: TECHNIQUES FOR RADIO WEAK LENSING 2014

DATE: 6-7/10/2014   TIME: 2 DAYS

LOCATION: *MANCHESTER, UK*

MEETING WEBPAGE   *http://www.jb.man.ac.uk/meetings/rwl2014/*

HOST INSTITUTE: *JBCA, UNIVERSITY OF MANCHESTER*

PARTICIPANTS NO: *25*

MAIN LEADER: *UMAN*

REPORT:

1. Programme of the meeting

Time	Day 1 06/10/2014	
09:45	Introduction	
10:00	Neal Jackson (JBCA, Manchester, UK)	Radio astronomy for Weak Lensers
(IN PARALLEL)	Joe Zuntz (JBCA, Manchester, UK)	Weak Lensing for Radio Astronomers
11:00	Coffee	
11:30	Prina Patel UWC, South Africa)	A Brief History of Radio Weak Lensing
12:00	Barney Rowe UCL, UK	The third Gravitational Lensing Accuracy Testing Challenge (GREAT3)
12:30	Lunch	
14:00	Ivan Marti-Vidal OSO, Sweden	UVMULTIFIT. A versatile tool for fitting astronomical radio interferometric data
14:30	Julien Girard CEA, France	LOFAR and SKA Sparse Image Reconstruction
15:00	Sarod Yatawatta (remote) Astron, Netherlands	ExCon: Exascale imaging and more
15:30	Coffee	
16:00	Marzia Rivi Oxford/UCL, UK	Galaxy Shape Measurement for Radio Weak Lensing with SKA
16:30	Constantinos Demetroullas JBCA, Manchester, UK	A galaxy-galaxy lensing measurement by cross correlating optical and radio data
19:00	Meeting Dinner at Croma Manchester	

	Day 2 07/10/2014		
10:00	Jimmy Tarr Portsmouth, UK	Direct shear mapping from UV visibilities	
10:30	Ben Metcalf Bologna, Italy	Gravitational Lensing of Cosmological 21 cm Emission	
11:00	Coffee		
11:30	Lee Whittaker JBCA, Manchester, UK	Separating weak lensing and intrinsic alignments using radio polarization information	
12:00	Neal Jackson JBCA, Manchester, UK	Radio observations of the Superclass field	
12:30	Lunch		
14:00	Sphe Makhathini Rhodes University, South Africa	CEILING-KAT: Online End-to-End simulator for SKA Phase I and its Pathfinder Missions.	
14:30	Ian Harrison JBCA, Manchester, UK	Future Radio Weak Lensing Experiments	
14:45	Ian Harrison / Prina Patel	Proposal for a radio GREAT Challenge.	
	Leading to...	Discussion & Coffee	

2. Scientific Summary

The aim of this meeting was be to bring together people working on both radio data analysis and imaging techniques with those working on weak lensing shape measurement techniques and begin to address the problem of performing cosmic shear measurements using radio data. This was the first ever meeting dedicated to radio weak lensing.

The SKA has the potential to be competitive with other large facilities such as Euclid and LSST in constraining the Dark Energy equation of state to the 'Stage IV' level specified by the Dark Energy Task Force by measuring the weak gravitational lensing of background galaxies. Furthermore, measuring a weak lensing signal in the radio presents a number of unique advantages, probing higher redshifts than optical and near-IR weak lensing and in using novel techniques to overcome systematic effects, which can severely limit optical/NIR experiment's ability to do precision cosmology. Leading up to the SKA a number of surveys, including SuperCLASS, CHILES-con-pol and VLASS will provide data to demonstrate our ability to do weak lensing in the radio and probe the micro-Jy source populations useful for weak lensing.

However, extracting a weak lensing signal from data is hard, requiring the measurement of galaxy morphologies to exquisite accuracy. In the optical/NIR lensing community the Shear TEsting Programme (STEP) and GRavitational lEnsing Accuracy Testing (GREAT) challenges have run for ~10 years, challenging the community to blindly measure galaxy shapes in simulated data. These challenges have been crucial in identifying and solving the data analysis problems in image-plane weak lensing and the necessary levels of fidelity are now beginning to be achieved. For data from radio interferometers we are

only now beginning this process, which will require processing of enormous data volumes and implementation of new image analysis techniques.

At this meeting a number of issues to do with creating a successful environment for radio weak lensing were discussed. A number of entirely new methods for measurement of galaxy source shapes for weak lensing from radio data were presented, including a new method, which seeks to infer the cosmic shear directly from visibility data without explicitly measuring the shapes of individual objects. In addition, a number of techniques were presented which assist in the preservation of precise morphology when producing radio images – a topic also relevant for many other future applications of radio astronomy. Excellent discussion was generated between those developing these radio techniques and the experienced optical weak lensing scientists also participating. To assist in this dialogue, the meeting also began with parallel 'masterclasses' for radio astronomers in the subtleties of weak lensing analyses for cosmology and for those with an optical weak lensing background on the realities of using data from a radio interferometer.

In addition, a number of presentations dealt with ongoing efforts to actually detect weak lensing in radio data, as well as previewing what should be possible with future surveys. In the final session a discussion session produced the beginning of the now-ongoing radioGREAT project (http://radiogreat.jb.man.ac.uk) and contained initial discussions of the most important questions, which need to be addressed in order for radio weak lensing to fulfil its promise as a powerful cosmological tool.

Participants principally came from the UK, with small minorities from continental Europe and South Africa. A majority of talks were presented by PhD students and young Post-Docs. The gender balance (M/F) was 3/1 for the organising committee, 13/2 for presenting speakers, 18/5 for attendees and 3/3 for session chairs.
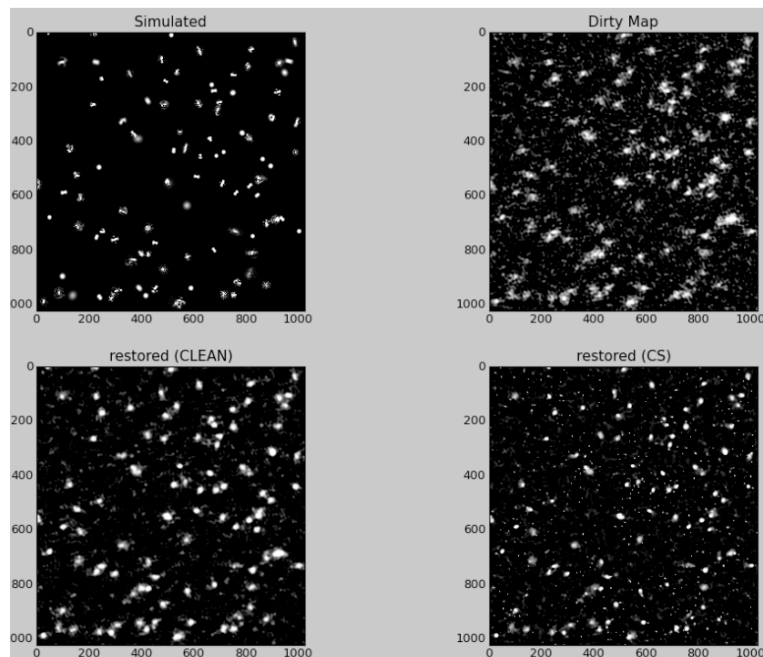

Figure 1. From Julien Girard (CEA), showing improved recovery of realistic galaxy morphologies by Compressed Sensing (CS) techniques over traditional CLEAN map-making.
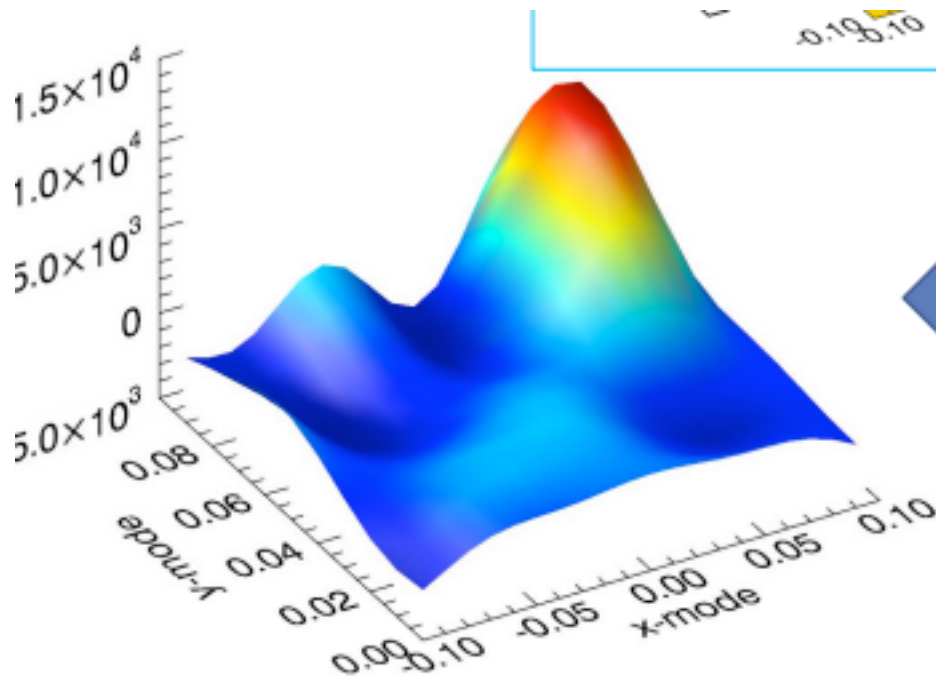
Figure 2. From Jimmy Tarr (ICG Portsmouth), showing recovery from simulated radio data of a single cosmic shear mode at (0.10, 0.10) directly from the UV/visibility plane without imaging or explicitly measuring ellipticities of individual sources. This is the first time this technique has been demonstrated.

3. Attendance list (incl. participant names, affiliation and country) signed by the participants and confirmed by the organizer

Ian Harrison	University of Manchester, UK
Prina Patel	University of the Western Cape, South Africa
Barney Rowe	University College London, UK
Sarah Bridle	University of Manchester, UK
Michael Brown	University of Manchester, UK
Neal Jackson	University of Manchester, UK
Ivan Marti-Vidal	Onsala Space Observatory, Sweden
Marzia Rivi	University of Oxford/University College London, UK
Jean-Luc Starck	CEA, France
Michael Tarr	ICG, University of Portsmouth, UK
Alkisitis Pourtsidou	ICG, University of Portsmouth, UK
Lee Whittaker	University of Manchester, UK
Sphe Makhathini	Rhodes University, South Africa
Matt Jarvis	University of Oxford, UK
Jason McEwen	University College London, UK
Sarod Yatawatta	ASTRON, Netherlands
Joe Zuntz	University of Manchester, UK
Constantinos Demetroullas	University of Manchester, UK
Anna Bonaldi	University of Manchester, UK
Ben Metcalf	University of Bologna, Italy
Rafal Szepietowski	University of Manchester, UK
Jeff Wagg	SKA Organisation, UK
Ben Tunbridge	University of Manchester, UK
Julien N. Girard	AIM/IRFU/SAp/CEA-Saclay, UK

4. Financial Report / RadioNet3 contribution

RadioNet3 funding was used logistics.

5. Conference Proceedings and Web page

Slides from talks given at the meeting are available on the conference website at
http://www.jb.man.ac.uk/meetings/rwl2014/