Magnetism KSP Report

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2015 LOFAR Users Meeting, Assen, June 1-3

Recent Achievements - Technical & Observational

- Technical:
  - Participation in development of calibration techniques.
  - Development of calibration pipeline on Jülich cluster.
- Observational:
  - Science quality images for several galaxies: IC342, Abell 1682, M101, NGC 5775.
  - Images of extended total emission from M51 and NGC891: thermal absorption and cosmic-ray propagation.
  - Low-frequency spectra within M51: evidence for diffusive propagation of CR electrons.
  - Faraday spectra of 6 polarised background sources in the M51 field.
  - Low-frequency spectra of several galaxies extracted from the MSSS HBA survey.

Galaxy	Array	Responsible	Observation date	Status
NGC891	HBA	D. Mulcahy	Nov. 2012	Mostly processed
M81/82	HBA	B. Adebahr	March 2013/ Jan. 2014	Mostly processed
M81/82	**LBA**	B. Adebahr	March 2013	Pending
IC342	HBA	C. Van Eck / R. Beck	Feb. 2013	Partly processed
IC342	**LBA**	A. Horneffer	Feb. 2013	Pending
NGC3627/3628	HBA	R. Paladino	March 2013	Partly processed
M82	HBA –long baselines	E. Varenius	March/April 2013	**Ready, in press**
NGC4631	HBA	R.J. Dettmar	April 2013	Pending
M51	HBA	D. Mulcahy	April 2013	**Ready, published**
M101	HBA	Sarrvesh S. Sridhar / G. Heald /	June 2013	Mostly processed
NGC6946	HBA	W. Jurusik / C. Chyzy	July 2013	Mostly processed
IC10	HBA	V. Heesen	Aug. 2013	Pending
IC10	**LBA**	V. Heesen	Aug. 2013	Pending
Stephans Quintet	HBA	B. Nikiel-Wroczynski	Sept. 2013	Partly processed
M33	HBA	R. Paladino / M. Iacobelli	Oct. 2013	Processing started
M33	**LBA**	R. Paladino	Oct. 2013	Pending
NGC628	HBA	D. Mulcahy	Nov. 2013	Pending
NGC3432	HBA	A. Miskolczi	Nov. 2013	Pending
NGC4449	HBA	C. Chyzy	Feb. 2014	Processing started
NGC4258	HBA	B. Adebahr	Feb. 2014	Observed
NGC3079	HBA-long baselines	E. Varenius	March 2014	Partly processed
NGC4490	HBA	B. Nikiel-Wroczynski	April 2014	Observed
Virgo Cluster	HBA	F. de Gasperin	April 2014	Processing started
NGC5033	HBA	K. Sendlinger	May 2014	Processing started
NGC5775	HBA	G. Heald	May 2014	Processing started
NGC5907	HBA	A. Miskolczi	June 2014	Observed
M51	**LBA**	D. Mulcahy	June 2014	Processing started
NGC891	**LBA**	B. Adebahr	Nov 2014	Observed
M31	HBA	A. Horneffer / R. Beck	Nov 2014	Observed
M31	**HBA-High**	A. Horneffer / R. Beck	Nov 2014	Observed
NGC5055	HBA	K. Sendlinger	April 2015	*To be observed*

Status: Jan 2015

Observatory Issues for the MKSP

- Station-calibration is done very infrequently:
    - Official policy for the international stations is to re-calibrate when there were changes to the hardware.
    - When the clock-distribution boards in DE601 were changed in 2014 science support took too long to respond.
        - Performing station calibration on a regular basis and checking the results would point out problems in the stations much faster (even if the calibration values don't usually change much).
- Proposals asking for more processing time than can be granted have its observing time is automatically reduced.
- Access to CEP3 is not managed in a way reflecting (student) reality:
    - Assumes that the astronomer works full time on their project for 3 months, and then the project is done. Most people don’t work this way…
    - May be better if they didn't get more or less exclusive use of a CEP3 node for a short time, but would get limited storage space and total CPU time but over a significantly longer period.

MKSP Science Issues & Progress

- Issues:
    - Faraday depolarisation stronger than expected: No polarised diffuse emission from nearby galaxies detected so far.
    - Limited timescale of MKSP activities in Germany: DFG funding ends in 2016.
        - AWimager needs to be faster and be capable of producing spectral cubes.
        - Dipole and station beam models need improvement and regular updates.
        - A better understanding and control of the LOFAR beams.
- Progress:
    - Restructured the KSP to: make the science working groups more efficient, emphasising our broader range of science interests (i.e, not just galaxies) and improving communication and to advance our technical capability.

Future MKSP Work

- Re-instituted busy weeks to advance polarisation processing capabilities, and support science goals.
- Utilising Virgo Cluster data to search for diffuse polarisation in galaxy groups.
- Process polarisation from MSSS HBA survey (e.g., Polarisation of the Galactic foreground and search for background polarised point sources).
- Utilise deep ELAIS-N1 observations to study polarisation properties of the faint radio galaxy population.
- Search for magnetic fields in intergalactic filaments
- Searching the vertical extensions or extended disks of galaxies where polarisation might be higher to trace the structure of ordered **B**-fields in regions far from the sources of ISM turbulence.
- Continued and extended collaboration with the Surveys, EoR, and Transients KSPs.
- Continued search for a polarised calibrator source for a reference polarisation angle.

Polarisation & RM synthesis

- Polarisation & RM-synthesis is like communism: simple to do in theory.
- Normal data reduction, Ionospheric RM-correction, image, RM-synthesis.
- Baselines from the two HBA “ears” at each station result in cross-talk — probably due to improperly shielded cables — so these baselines must be flagged out.
- Below left: M51 “ears in”; right, “ears out”.