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VENTSPILS AUGSTSKOLA

ASTRON



Project „Building on Advanced Lofar Technology for Innovation, Collaboration, and Sustainability” (BALTICS)



Training Week „Radio interferometry and related techniques”

August 29 – September 2, 2016

Ventspils University College

Day	Time	Topic	Location
Monday, August 29	10:30	Morning coffee	C400
	10:45	Welcome speech (Director of VIRAC, Vice-rector for Science)	C406
	Introduction to Python (Dr. Neal Jackson)		
	11:00	Rationale for Python: overview of its use in modern astronomy and in radio interferometry. Interoperability with the interferometry software discussed in TW1. Relation of Python to other languages (e.g. Fortran, C). Basic introduction: data types and variables, lists, tuples and dictionaries; list data operations.	C406
	11:45	Tutorial session: getting started with Python, setup and initialization simple operations on Python variables.	C406
	13:00	Lunch	D103
	14:00	Control flow: loops and looping. Dictionary loop functions. Function definitions, packages and administration. Input and output: string and file I/O. Use of Python library functions. Python packages. NumPy and SciPy: Python packages for scientific computing. NumPy arrays, array indexing and array operations. Stacking and splitting, element operations.	C406
	15:45	Tutorial session: Practical examples of logical structuring, basic use of Python packages.	C406
	18:15	End of Day 1	
Tuesday, August 30	Python (continued (Dr. Neal Jackson))		
	8:30	Morning Coffee	C400
	9:00	Input and output from files. String operations. Use of some library functions: FFTs, linear algebra, random number generation/Monte Carlo methods, sorting and searching, mathematical functions. Applications of SciPy.	C406
	9:45	Tutorial session: Practical examples of use of more advanced Python packages.	C406
	12:15	Lunch	D103
	13:00	FITS files. Matplotlib, astronomy packages. Selection from advanced topics e.g. interactive widgets, use of Python together with CASA	C406
	14:00	Tutorial session: Practical examples; more advanced topics with astronomical relevance.	C406
18:30	Dinner		



Wednesday, August 31	Paralell sessions		
	Modern imaging techniques((Group 1*) Dr. Anna Scaife)		
	Basic interferometry ((Group 2*) Dr. Neal Jackson)		
	8:30	Morning Coffee	C400
	9:00	Interferometry expressed by Measurement Equation, Jones matrices. New techniques in interferometry: deconvolution algorithms, compressed sensing techniques.	C405
	9:00	Basics of interferometry. Van Cittert-Zernike theorem, u-v plane, aperture synthesis, visibility measurement. Brief discussion of field of view limitations.	C406
	10:00	Tutorial session: Practical exercises around the measurement equation and deconvolution algorithms.	C405
	11:00	Tutorial session: Introduction to CASA. Examination of data.	C406
	12:30	Lunch	D103
	13:00	Wide field mapping; more about the w-term. Direction dependent calibration. Applications to LOFAR.	C405
	13:00	Deconvolution and the CLEAN algorithm. Correction of telescope-based gains; self-calibration. Practical map-making.	C406
	14:00	Tutorial session: Practical exercises on wide-field imaging.	C405
	14:30	Tutorial session: Calibration and imaging of data (demonstration, plus making of image)	C406
16:30	End of Day 3		
Thursday, September 1	Techniques of VLBI and longer baseline interferometers (Dr. Robert Beswick & Prof. Keith Grainge)		
	8:30	Morning Coffee	C400
	9:00	VLBI Science and specifics [context setting], why use VLBI/eMERLIN, calibration steps, delay & fringe calibration, other specifics (T_sys etc), polarization techniques in VLBI and other arrays	C406
	10:00	Tutorial session with VLBI/eMERLIN data. Focus on issues raised including delay calibration (and possibly wide-field imaging - if eMERLIN only); initial steps through to a basic calibrated data set and image; operation of e-MERLIN/EVN Pipelines)	C406
	12:30	Lunch	D103
	13:30	Radio frequency interference, mitigation techniques, case studies from existing interferometers systems.	C406
	14:30	Tutorial session: Introduction and practical on polarization RM synthesis.	C406
	17:00	Coffee break	C400
	17:15	Lecture and practical demo on Spectral line science and data reduction for e-MERLIN/VLA/VLBI.	C406
	End of Day 4		

*Group 1	Those who have attended Training Week 1 or have some previous experience. Wide-field imaging is relevant for many modern survey telescopes, in particular LOFAR, and will be vital for the SKA.
*Group 2	Those new to interferometry. This will be a condensed and partial version of the course given in Training Week 1, to provide a basic overview of the techniques.



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Friday, September 2	Techniques of VLBI and longer baseline interferometers (continued (Dr. Robert Beswick & Prof. Keith Grainge))		
	8:30	Morning Coffee	C400
	9:00	Short lecture: recap and discussion of issues raised in Thursday's material.	C406
	9:45	Tutorial session: continuation of VLBI/eMERLIN tutorial with the aim of obtaining a basic image. Continuation of tutorials on more advanced topics.	C406
	11:45	Coffee break	C400
	12:00	Radio telescopes/interferometers around the world, including SKA.	C406
	13:00	Lunch	D103
	14:00	Life cycle of projects. Introduction to applying for telescope time; how to apply, proposal writing, introduction to data simulation packages. Proposal preparation and potential ideas.	C406
	15:00	Group activity. Proposal preparation from list of initial ideas; preparation of short (1-page) proposals; discussion of technical feasibility; panel judgement and discussion of proposals.	C406
	17:30	End of Day 5	