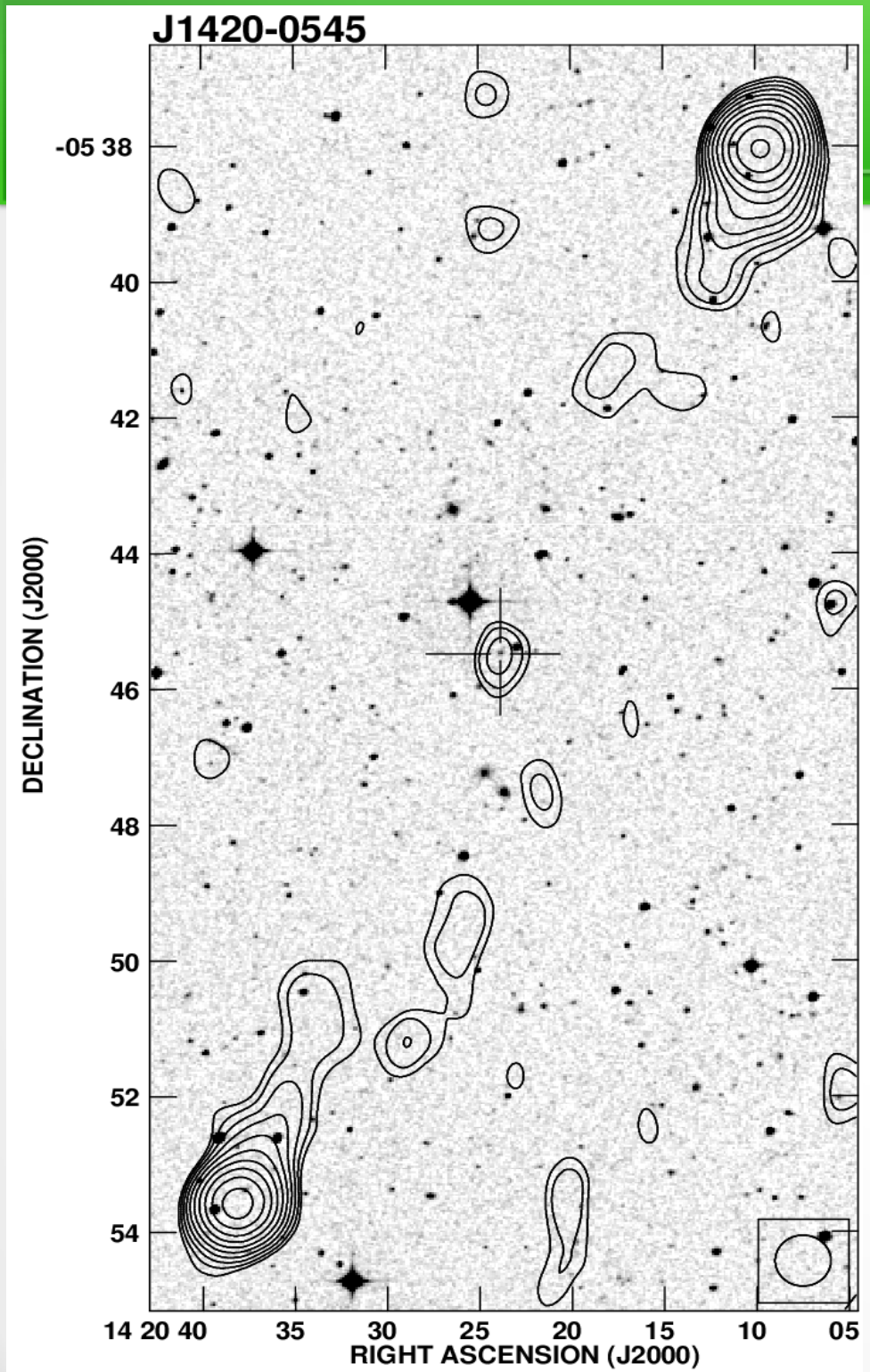
Measuring distance to the largest structures in the Universe

Jerzy Machalski
Dorota Kozieł-Werzbowska
Staszek Zoła
Agnieszka Kuźmicz
Marek Jamrozy
Małgorzata Bankowicz

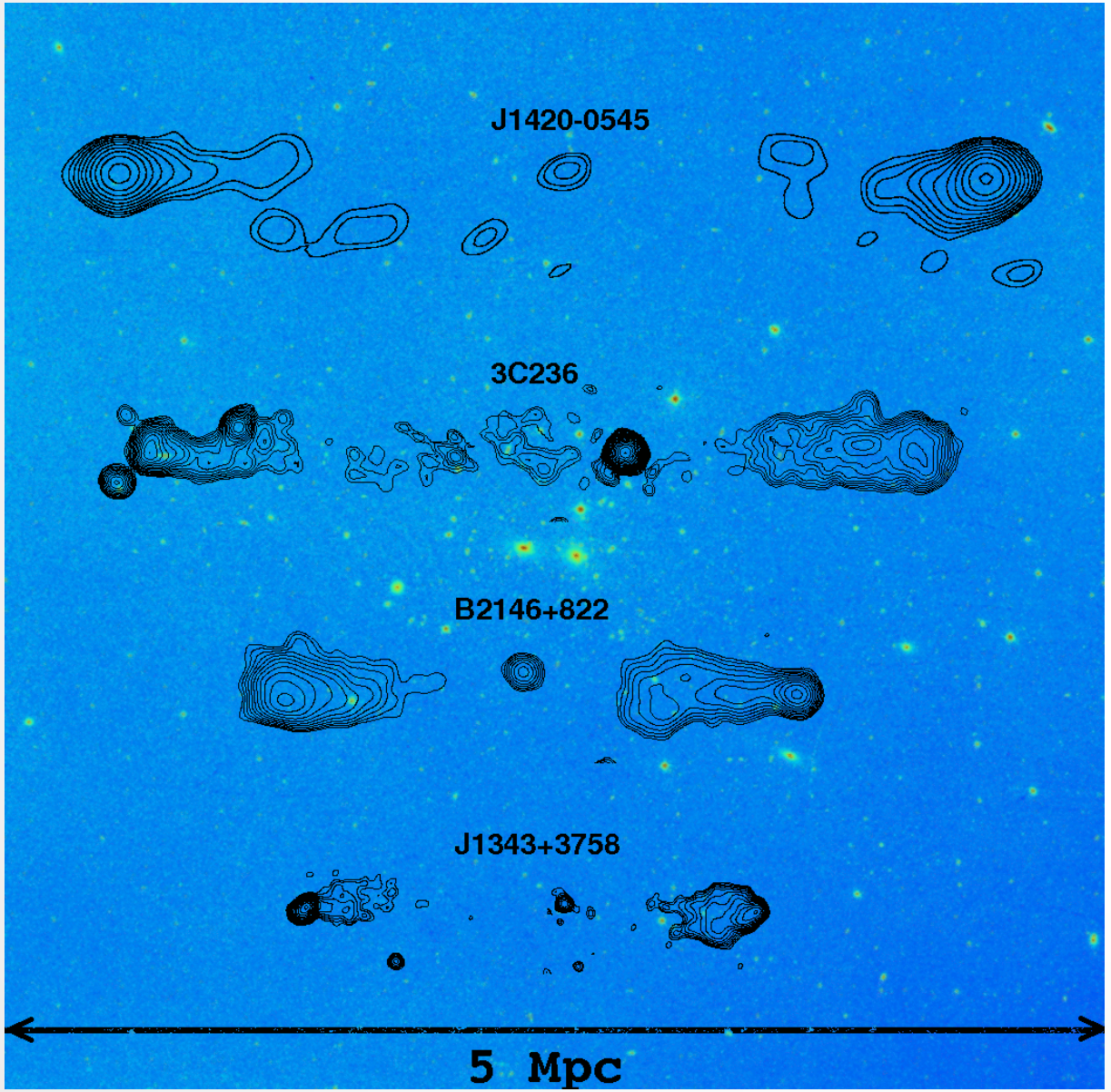
CAMK, Warsaw, 22 May 2013



Giant Radio Galaxies

- The largest extragalactic radio sources (D>1Mpc, H0=50km\s\Mpc)
- Serve as laboratories for studies of the evolution of internal magnetic fields
- Help to constrain dynamical models of the source evolution
- Are probes of the intergalactic and intracluster environment on Mpc scales.

Giant Radio Galaxies



The largest radio galaxies in the Universe are comparable in size with galaxy clusters.

SALT Project

Title: Giant Radio Galaxies as a probe of the cosmological evolution of the Inter Galactic Medium (IGM)
Background: In adiabatically expanding Universe with diffuse and uniform IGM, the IGM pressure increases with redshift as $p_0(1+z)^5$ (Subrahmanyan & Saripalli, 1993). The preasure of the relativistic plasma in the radio bridges of GRGs is in equilibrium with the preasure of the gaseous environment.
Aim: to measure distance to the sample of GRG candidates, and calculate the physical properties of their radio lobes, and hence preasure and density of the IGM.

Observations - Previous semesters

2009-2-POL-001: Imaging – no observations taken

2011-2-POL-001: Imaging – no observations with good quality

2010-1-POL-005: Spectroscopy – Obtained data for 2 galaxies (J2121-0101, J2316-0102).

2011-3-POL-008: Spectroscopy – 6 galaxies observed successfully, there were attempts to observe 4 others

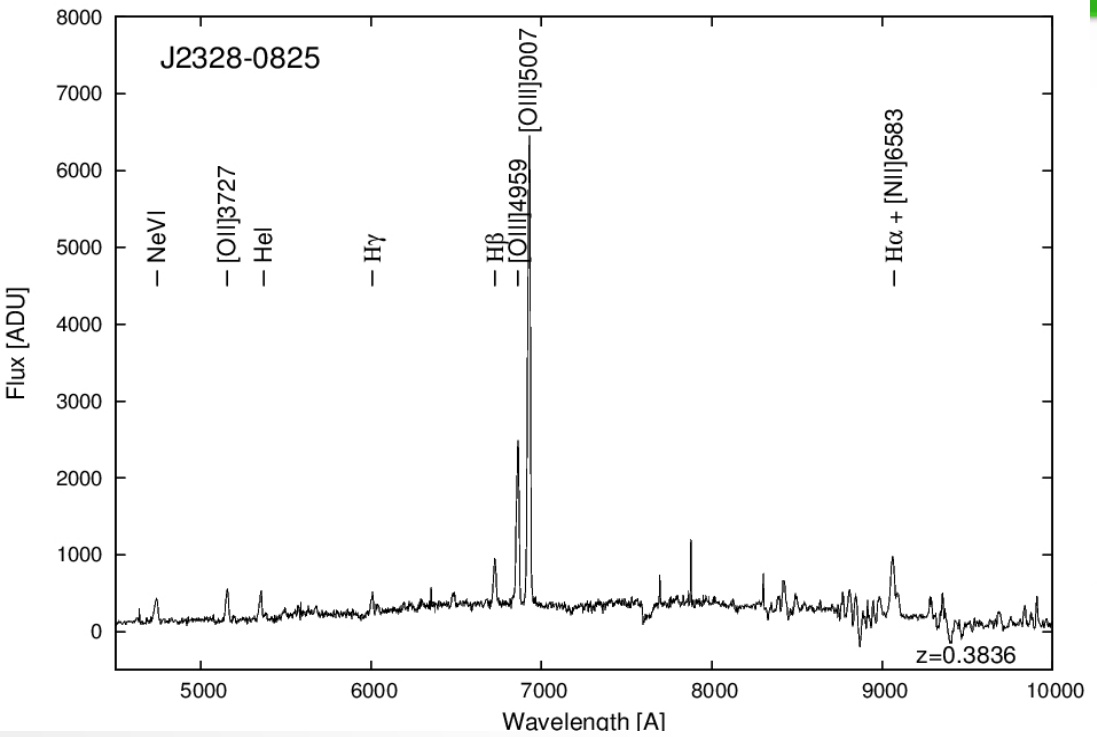
Observations – Semester 2012-2

Proposed observations of 14 galaxies, observed 7: J0003+0351, J0022-0818, J0117-0111, J0117+0026, J0202-0939, J2320-1320, J2328-0825

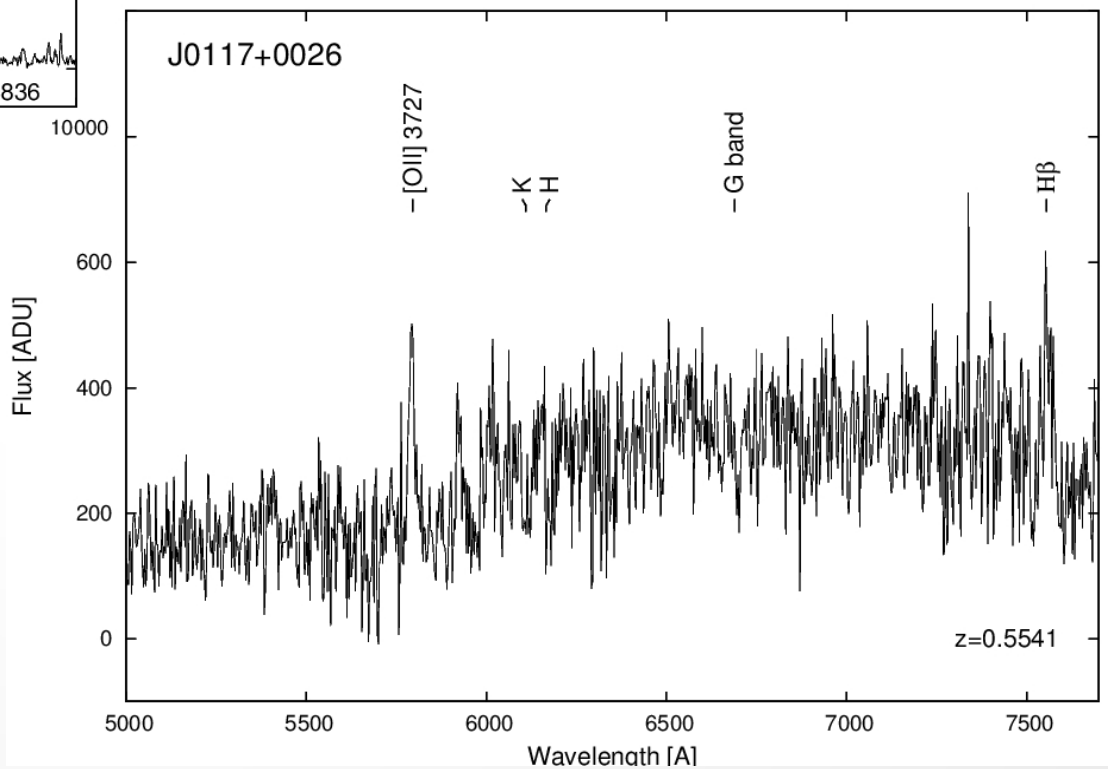
Instrument	–	RSS
Mode	–	Spectroscopy
Grating	–	PG0300
Mask	–	Longslit
Moon	–	Grey
Transparency	–	Photometric
Seeing	–	1.5 arcsec
Calibrations	–	5x flats
		arclamp

Each galaxy was observed at two different grating angles to exclude the possibility that any emission line will fall into gap between CCDs.

Observations – Semester 2012-2



The best ...



...and the worst quality spectra

Results - Semester 2012-2

Redshifts:

J0003+0351	0.0951
J0022–0818	0.5708
J0117–0111	0.3770
J0117+0026	0.5530*
J0202–0939	0.7670
J2320–1320	0.3928
J2328–0825	0.3836

All galaxies, except the brightest galaxy J0003+0351, are distant objects.

*) There is only [OII]3727 clearly visible in the spectrum and there are only faint signatures of H, K, G band and Hβ.

Observations quality

- Observations made mostly in accordance with the proposed requirements.
- In the case of some objects (J0117+0026, J0202-0939) only one spectrum is useful. It is most likely due to the absence of guiding. In the second spectrum object is no longer visible in the slit.

Future work

- Knowing redshifts of the GRGs we will model available radio data and put constraints for the density of the radio lobes surroundings.
- One Master Thesis based on the SALT data is in preparation.
- Publication based on obtained data is planned for summer.