



Magnetization of large-scale structure of the Universe from polarimetric surveys of the sky

V. Vacca⁽¹⁾

(1) INAF-Osservatorio Astronomico di Cagliari, Via della Scienza 5, I-09047 Selargius (CA), Italy, e-mail: valentina.vacca@inaf.it

Recent radio observations demonstrated that magnetic fields inhabit not only the galaxy cluster center but also their outskirts and can be found as well beyond, along the filaments connecting them. While precious information on magnetization of the large-scale structure of the Universe can be derived from diffuse extended synchrotron sources observed in total intensity and in polarization in these environments, an alternative and complementary technique is represented by the rotation of the polarization angle of the signal of background radio galaxies (Faraday effect). Polarimetric radio surveys of the sky are a precious tool in order to study in a statistical fashion the magnetization of the galaxy clusters and of the cosmic web through this effect, since they allow us to infer the rotation measure for a collection of radio sources.

Recently, polarization data from the LoTSS survey performed with LOFAR at 144 MHz allowed us to detect for the first time magnetic fields in filaments of the cosmic web through their Faraday effect on the signal from about one thousand background radio galaxies. Future surveys, as that one planned with the SKA-MID telescope between 950 and 1760 MHz, will enable the production of catalogs of rotation measure for about 2-3 millions of radio sources, that can be used to understand magnetic properties of a variety of environments. These radio surveys need to be complemented with sophisticated algorithms to shed light on the signature of weak magnetic fields as those in the large-scale structure of the Universe, easily buried by the observing noise and/or by the Galactic magnetic field.

During this talk, I will discuss novel approaches to study magnetic fields in galaxy clusters, filaments and voids, exploiting the data coming from the new radio astronomical polarimetric surveys with advanced statistical approaches.