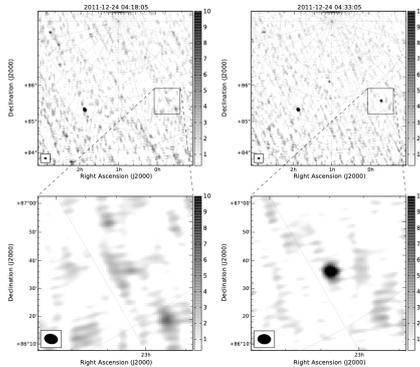# Radio Transients

Searching for radio transients with the SKA precursors and pathfinders

The Universe is a highly active place with transient sources being found every day at a wide range of wavelengths and now even with multi-messenger signals. The goal of this project will be to search for transient radio sources in a large dataset from the SKA pathfinder/precursor facilities, typically LOFAR, AARTFAAC or MeerKAT. We will focus on development of new transient search strategies and/or in characterising the transient populations. In the event of a transient detection, the student will endeavour to identify its origin.

Theory

by Antonia Rowlinson

Typically, transients are found at higher frequencies than radio (e.g. optical or gamma-ray) using wide-field transient surveys and, recently, multi-messenger transient surveys such as using gravitational waves. These transients are then followed-up at radio frequencies to study their radio afterglows. Therefore, we know that there are a number of radio transient sources observable in the sky. Until recently, however, they were proving elusive to find using large surveys at radio frequencies as they are typically faint and rare.

The SKA will revolutionise the field of radio transients, by using highly sensitive observations of large areas of the sky. Then, we expect to find many transient sources (see for instance Paper 1). Using the SKA precursor and pathfinder facilities, we can already begin SKA transient science due to their improved sensitivities and fields of view. We are producing the first competitive transient surveys and developing tools to automatically search the large volume of data.

The theoretical aspect of this project has two parts:

- be able to describe the population of transient sources that the dataset will be able to probe. See for instance Figure 4 in Paper 1.

- be able to use and interpret statistical analysis of the dataset obtained. For instance understand the detection statistics, the variability parameters and how to calculate transient rates.

Applications

by Antonia Rowlinson

As radio transient sources are proving to be rare, transient teams require vast amounts of data to search for them. Sufficiently large datasets are being produced via survey observations are being obtained at ∼100 MHz by LOFAR (The Low Frequency Array, centred in the Netherlands) and at ∼1.4 GHz by the MeerKAT array. Many of these observations are available for the transient teams to utilise for blind searches for radio transient sources. These datasets may be treasure troves containing new and unique transient sources.

The student will take a recent dataset from either LOFAR, AART-FAAC or MeerKAT and search for radio transients by sub-dividing the observations into a range short duration snapshot images. These images will then be passed through the LOFAR Transients Pipeline (Paper 2). They will filter the transient candidates and identify if any are real transient sources. For an example large scale radio transient survey, see Papers 3-5.

Upon the detection of a good transient candidate, the student will conduct more detailed analysis of the radio data and search for archival multi-wavelength data to aid in the identification of the type of transient source. Where appropriate, the student will also obtain multi-wavelength follow-up observations.

See also

Paper 1
Paper 2
Paper 3
Paper 4
Paper 5

Contact

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