Constraining the continuum background of extragalactic origin by precision radio background measurements.

Experiments that aim to detect the redshifted 21cm signal do so by making precision radio background measurements at low frequencies. These measurements also produce a volume of information on all-sky averaged galactic and extragalactic radio continuum which is yet not studied in detail. A purported detection of the redshifted 21cm signal in 2018 stirred in a controversy on whether there exist an excess radio background of extragalactic origin. This project will develop a method and corresponding algorithm to separate the isotropic and anisotropic components in the all-sky radio background data. The isotropic part, being of extragalactic origin can provide an upper limit on the volume averaged emissivity of the extragalactic radio source population. This will be compared with the currently available radio source-counts from various radio surveys and estimates from the diffused all-sky maps and will address the question whether there exists an excess extragalactic isotropic radio background. The work would involve generating simulated dataset for testing the method as well as real data from earlier observations.

Research Field
Cosmology, Radio Astronomy

Project Suitability
Masters, Internship

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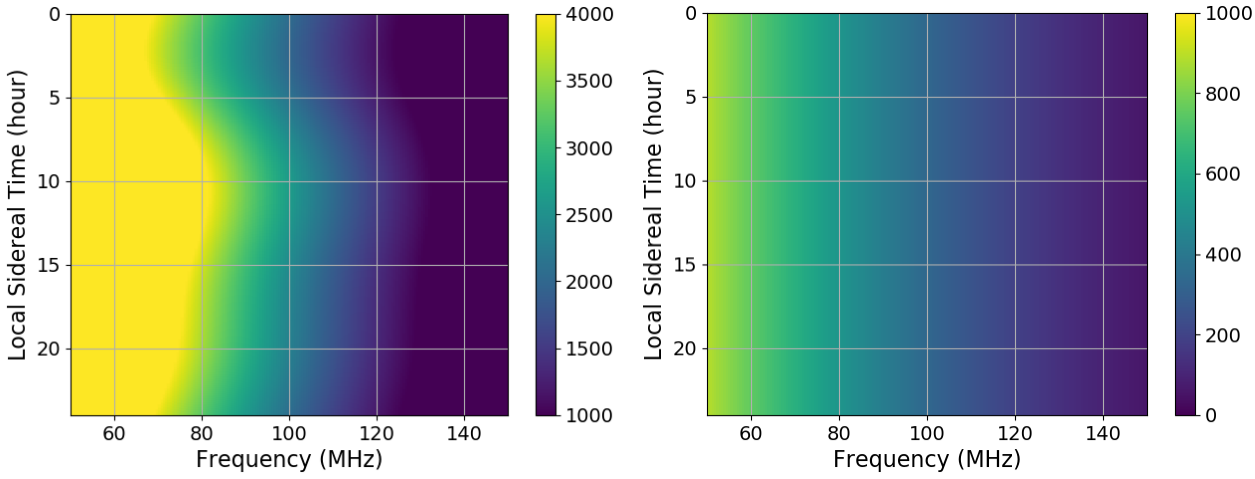
Following the development of the foreground separation method, we would study the effect of foreground modelling on the detectability of the redshifted 21cm global signal. As a result of foreground separation, a part of the 21cm signal is always lost. Such signal loss will not only reduce the chances of a 21cm detection but also can render a false detection and/or distorted cosmic history. We will investigate the possibility of detecting the redshifted 21cm global signal in the presence of signal loss due to radio background modelling. This project also has the potential to be converted into a Ph.D thesis.

This project is most suitable as a Master's thesis with a solid background in Computer/Data Science, Telecommunication engineering, physics and astrophysics, maths. A good coding efficiency in any language, (preferably in python and/or in C) is needed. A part of this work may also be offered as a 6 month's project for domestic or international students who wish to work as interns provided the student can make funding arrangements for themselves.



Left: A simulated data set showing the radio continuum background measured by a single element radio telescope over 24 hours. Right: The isotropic component isolated from the radio background data using the initial algorithm which will be developed further as a part of this project.

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