Adaptive Spatial RFI Mitigation For Radio Astronomy
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Abstract: Nowadays, performing radio astronomical observations becomes challenging as the electromagnetic spectrum occupancy severely increases. A radio telescope’s high sensitivity, required for recovering weak cosmic source signals, makes it extremely vulnerable to any form of Radio Frequency Interference (RFI), even when it is located in a Radio-Quiet Zone or observing protected frequencies dedicated to radio astronomy. The current RFI mitigation approach adopted by astronomers consists of flagging and excising corrupted data in the Time-Frequency plane, usually leading to a large loss of data. However, the spatial information provided by modern antenna array radio telescopes can be used to perform spatial RFI mitigation, and theoretically retrieve uncorrupted astronomical data even in a polluted environment.

Classical beamforming techniques can be applied to radio telescope arrays, but their quality is highly dependent on the characteristics of the interfering signal. They usually perform poorly with weak RFI, and this is often the case in radio astronomy as RFI gets attenuated by the array side lobes.

The projection approach consists of projecting the RFI subspace out of the observed data vector space, creating deep nulls in the direction-of-arrival of the RFI. However, a good estimation of the RFI subspace is required. This estimation has to be performed adaptively, based on the output data of the radio telescope. The statistical properties of the interfering signal can also be used to improve the accuracy of the estimation. This talk will cover the concept of an adaptive spatial RFI mitigation algorithm, and discuss several solutions to achieve good rejection of interference and good retrieval of cosmic sources signals.

Bio: Gregory Hellbourg received his Engineering and M.S. degrees in Signal and Image Processing, and his Ph.D. degree in Signal Processing, from the University of Orléans, France, in 2010 and 2014. He is currently a postdoctoral fellow at CSIRO Astronomy and Space Science in Sydney, Australia. His current research interests include array signal processing for radio astronomy and RFI mitigation.