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AN OVERVIEW OF RFI MITIGATION FOR RADIO ASTRONOMY

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The continuous development of commercial radio technologies affects the electromagnetic spectrum occupancy. Despite the enforcement of protective legal measures (e.g. frequency allocations and radio quiet zones), radio astronomy suffers from data corruption due to out-of-band emissions (e.g. spectral leakage or intentional leakage) and moving transmitters (e.g. satellites or airplanes). The increased sensitivity and reduced directivity of next generation astronomy receivers intensifies their vulnerability to Radio Frequency Interference (RFI).

Notch filtering and energy flagging have reached their limits as the simple excision of data corrupted by strong RFI significantly reduce the productivity of modern telescopes, requiring longer on-sky integration - and associated storage capabilities - to reach astronomical sensitivities. These methods also prevent any astronomical information recovery in the presence of continuous interference.

Advanced signal processing techniques can now realistically be implemented on astronomical instrumentation as computational resources become affordable and available. In particular, the early detection of weak RFI is made possible by exploiting the sparsity of artificial transmission features (e.g. higher order statistics or cyclostationarity) as opposed to the classical Fourier domain. Moreover, those features enable the accurate estimation and subtraction of the interference contribution to the collected data, permitting in turn the recovery of natural astronomical emissions.

We will review the state-of-the-art in RFI mitigation for radio astronomy, and address the future challenges and proposed solutions against the rapid deployment of human radio applications. We focus on real-time methods, of broader interest than offline methods to face the big data produced by next generation telescopes.