New Radio Frequency Interference Mitigation Techniques in the Context of 21-cm Cosmology
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Ultra-faint radio frequency interference (RFI) that is below the single visibility thermal noise floor is of particular concern for deep 21-cm cosmology observations. We introduce Sky-Subtracted Incoherent Noise Spectra (SSINS) which can be used for ultra-faint RFI identification and mitigation. In this talk, we will describe the SSINS algorithm, demonstrate its capabilities via images and other quality metrics, as well as assess its impact on 21-cm cosmology power spectrum measurements.

The contrasting RFI environments of the Murchison Widefield Array (MWA) and the Hydrogen Epoch of Reionization Array (HERA) allow for a comprehensive demonstration of the ability of SSINS to identify and excise RFI that is much fainter than can be identified by current state-of-the-art algorithms. The extremely clean RFI environment of the MWA allows for an isolated study of specific cases of extremely faint RFI. In contrast, HERA observations are generally significantly more contaminated than even the worst MWA observations, and so they provide a rigorous test of the ability of SSINS to distinguish between clean and contaminated data.

Other important qualities of the SSINS package include ease of use and very quick flagging implementation. A typical 2-minute MWA observation can be flagged in less than a second on a personal laptop, while a significantly more contaminated 10-minute HERA observation can be flagged in less than a minute. SSINS is implemented in a fully documented and fully tested open-source python package available on Github, and we will detail how future users can download and tune the package to their own data.