How do Polarized Foregrounds Affect 21cm EoR Power Spectrum Detection?

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Polarized foregrounds pose a threat for attempts to measure the 21cm Epoch of Reionization (EoR) power spectrum. Faraday rotation of natively polarized synchrotron emission modulates the phase of the polarization states Q and U by a factor of $\exp\{-2iRM\lambda^2\}$, where λ is the wavelength of incident light, and RM is a function of the magnetic field and electron density along the line of sight. This phase-factor is non-orthogonal to the frequency sine waves composing the EoR power spectrum, creating a potential leakage from polarized emission into the power spectrum. My recent paper, Moore, et al. 2013, exposes this as a problem, and presents a simulation estimating its severity.

Recent work by groups working on the Murchison Widefield Array (Bernardi, et al. 2013), and The LOw Frequency Array (Gießübel, et al. 2013) have measured polarized point sources at around 150MHz, eliminating much of the need for Moore, et al 2013 to extrapolate the statistical polarization properties of sources from higher-frequency measurements. The re-computed results of that simulation show that indeed, Moore, et al 2013 overestimated the amplitude of the $Q \to I$ leakage.

The Precision Array to Probe the Epoch of Reionization (PAPER) is a purpose-built instrument to measure the EoR power spectrum which at the time of this abstract's submission has the current best constraints on the power spectrum (Parsons, et al. 2013). Its measurement of $\Delta^2(k)$ in all four Stokes parameters provides the most powerful tool yet for measuring both the intrinsic polarized power spectrum and its leakage into I.

In this talk, I will discuss those efforts to constrain the polarization problem within the PAPER collaboration. These efforts are underway in two main areas 1) full-Stokes power spectrum characterization, and 2) characterizing potential contaminating sources by imaging, Rotation Measure Synthesis, and other more standard methods.