The Low Frequency Transient Sky

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Faced by many challenges, breakthroughs in the synoptic study of the low frequency transient sky ($\lesssim$ 300 MHz) have been scarce to date and certainly lag efforts at optical and gamma-ray wavelengths by a decade or more. However, the potential remains significant, particularly for populations of transients producing coherent emission, the latter expected to become increasingly prevalent at lower radio frequencies. The discovery in the last decade of a number of galactic center radio transients at low frequencies is an example of the potential opportunity for serendipitous discovery. In addition, extrapolation from the Sun and solar system planets, suggest that the signatures of both stellar coronal mass ejections and planetary magnetospheres will eventually be accessible to upcoming radio facilities, with potential implications for planetary habitability. On the extragalactic front, the prospect of prompt or precursor counterparts to compact object mergers becomes particularly significant in light of the recent detection of the first neutron star merger by LIGO/Virgo. A prompt or precursor radio transient would provide powerful independent confirmation, or even advance prediction, of LIGO/Virgo detected events, as well as offering greatly improved localization.

The large field of view offered by the latest generation of interferometers, such as LOFAR, MWA and LWA, has led to vastly greater survey speeds, accompanied by early evidence that new populations are finally within reach. This includes a very bright (~15 Jy) transient of 11 minutes duration detected by LOFAR at a frequency of 60 MHz in surveys of the North Celestial Pole, the nature of which remains a mystery. Data deluge remains the most significant obstacle to fully harnessing the survey speed of existing and future instruments and will require further development and optimization of direction-dependent calibration and wide-field imaging techniques and their utilization in autonomous transient detection pipelines.