Journal of Astronomical Instrumentation, Vol. 8, No. 1 (2019) 1902001 (1 page)

DOI: 10.1142/S225117171902001X

World Scientific
www.worldscientific.com

Preface

Interference Mitigation Techniques in Radio Astronomy

The passive use of spectrum in radio astronomy, coupled with the need to maximize instrument sensitivity, makes data acquisition acutely vulnerable to contamination by signals from technological and natural terrestrial sources. Though often located in "radio quiet" areas, remoteness of astronomical experiments and facilities is not always sufficient to avoid radio frequency interference (RFI). Various mitigation efforts, from spectrum coordination management to real-time and offline data processing techniques, are required in order to obtain usable data. This special issue is devoted to the impact of RFI on radio astronomy, and similar passive applications, and to techniques that can be used to mitigate or eliminate contamination.

The issue opens with two high-level discussions, of the impact of RFI and characterization of data loss due to RFI, both by W. A. Baan. Broadly speaking, the following articles focus on (i) characterization of interference environments and effects, and (ii) theory and application of techniques for mitigation.

Descriptions of interference, its sources and effects is the focus of articles by Le Vine (impact on observing earth from space), Deshpande (impact of satellite transmissions on observing from the ground), Winkel & Jessner (green energy — wind turbines), and Peel *et al.* (siting of the BINGO experiment, which requires low interference but also highly specific topography). Coincidentally, an article by Liju *et al.*, published in JAI in December 2018, also treated interference characterization, on a sub-antarctic island, motivated by observational cosmology at frequencies below 200 MHz.

Interference mitigation may be accomplished locally and in real time via statistical analysis and excision applied to fast-streaming data from individual receivers, as in work by Denman *et al.* and Nita *et al.* concerning a kurtosis-like estimator, and Buch *et al.* who focus on application of median absolute deviation.

These techniques may be used to clean the signal input to correlators used in synthesis imaging, but there Steeb *et al.* take a different route, working with post-correlation data products, combining interferometric calibration and RFI suppression in a single algorithm. Jeffs *et al.* focus on beamforming, which is well suited to high cadence monitoring of sources or mapping with moderate numbers of pixels. They examine an alternative to excision, as in application of a kurtosis threshold, specifically, a scheme to place nulls in cumulative gain toward "interferers," on the sky or horizon, and to track any motion over time. Relatedly, Zhang *et al.* treat computationally efficient optimization of beam calibration via maximizing received power and minimizing contributions from interference. At the other end of the spectrum is the approach of Gunaratne *et al.* in which digital signal-path hardware may be manipulated to attenuate interference and control noise.

Guest Editors
Kaushal D. Buch
Albert-Jan Boonstra
Gregory Hellbourg
Jonathon Kocz
Urvashi Rau

Assoc. Editor
Lincoln Greenhill