Progress Towards Detection of Pulsars and Fast Radio Bursts with Phased Array Feeds

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Astronomical transients are some of the most mysterious phenomena in the known universe, ranging from pulsars emanating from rotating neutron stars to the as-of-yet unexplained and rare fast radio bursts (FRBs). With only a small handful of documented FRB detections (11 at the time of this writing), no one has satisfyingly explained their origin. Before any headway can be made in explaining these transients, hundreds more must be observed.

There is great promise in detecting many new FRBs with the advent of phased array feeds (PAFs) due to their unparalleled wide fields of view (FoVs) and flexible control over beam steering angle and shape. Many in-development PAFs, however, are still in engineering test phases, and none are currently commissioned for regular surveys. Consequently, no documented cases of astronomical transients detected using a PAF exist to the authors' knowledge.

This presentation discusses the first documented detection of a pulsar using a PAF. This detection was made using the Australian Square Kilometre Array Pathfinder (ASKAP) instrument. The team at the Commonwealth Scientific and Industrial Research Organization (CSIRO) recently installed a PAF on one of the 12-meter dishes slated for ASKAP. The array feed consists of 96 dual-pol planar elements that were connected to a 192-port digital receiver and correlator. In addition, a dual-pol feed on the Parkes 64-meter telescope was cross-correlated with the PAF signals, which allowed for a cross-correlation-based beamformer weight vector calibration that enabled the detection of PSR J0835-4510, also known as the Vela pulsar, which is shown below.