ARTEMIS:
A Real-Time Data Processing Pipeline for the Detection of Fast Transients

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Time domain astronomy in the radio is a well-established field, thanks to the detection of fast, pulsed emission from neutron stars in the 1960s. Over the past decade, however, this field has burgeoned, thanks to the detection of new kinds of fast transients such as rotating radio transients (RRATs) and fast radio bursts (FRBs). FRBs are especially interesting, being non-repeating, having pulse widths of the order of a few milliseconds, and moreover, being dispersed by the ionized interstellar medium much more than what is possible due to the electrons in the Galaxy. This latter aspect leads to the idea that they originate in other galaxies. Only about a dozen FRBs are known, all of which have been discovered in the L band. The rarity of detections, along with their non-repeating nature, makes studying them extremely challenging. In this talk, I will describe ARTEMIS, a real-time data processing pipeline for the detection of fast transients. The pipeline implements polyphase channelization of incoming baseband data, an adaptive RFI excision algorithm, dedispersion powered by high-performance graphics processing units, and candidate extraction. The ARTEMIS deployment at the UK station of the LOFAR radio telescope has been used to conduct a search for FRBs at 145 MHz, searching values of dispersion measure up to 320 cm^{-3} pc. The survey resulted in no detection, setting an upper limit of FRB event rate of 31 sky^{-1} day^{-1} for 5-ms-duration pulses above 25 Jy. The non-detection has allowed us to constrain the spectral index of FRBs to $\geq +0.44$, which is different from typical pulsar spectral indices. ARTEMIS is now being deployed at the Arecibo Observatory, where it will be used for commensal, real-time searches for FRBs at 1400 MHz. A stand-alone version of ARTEMIS has also been developed to process the large amounts of available archival data.