**RAPID (Radio Array of Portable Interferometric Detectors)**

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We will discuss a new project to implement the Radio Array of Portable Interferometric Detectors (RAPID) for investigations of ionospheric phenomena, solar radio emission, the Galactic synchrotron background, and ultra-high energy cosmic rays via air-shower emission. The array will consist of 50-100 small, low-gain broadband antennas operating over at least 49 and 500 MHz. RAPID is designed to make flexible and coherent radio observations, capturing the amplitude and phase of the electric field across a user-defined aperture with user-defined spatial sampling. Key technical elements include a novel absolute broadband antenna calibration method, elimination of a clock distribution network with a compact, low power frequency standard in each unit, state-of-the-art high performance voltage data recording, and low power consumption, via use of the latest low-power digitizers and digital processing chips. By minimizing power per element the RAPID system will be able to use compact, portable solar panels and batteries.

Unlike existing arrays, RAPID will be operated without any cabling between the antennas and a central location, and can be shipped, deployed and physically reconfigured quickly and easily with ***zero*** site infrastructure. This creates a unique capability to locate and configure an imaging radio interferometer array, highly customized to the specific science goal of any given field campaign, thereby supporting science investigations that not before been feasible. When used in conjunction with existing incoherent scatter radar transmitters or transmitters of opportunity the array will provide a flexible capability for radar imaging of coherent and enhanced backscatter (e.g. E and F-region irregularities ; naturally or artificially enhanced ion acoustic lines). The RAPID system architecture is based on voltage data capture with all processing performed offline in software at the home institutions of investigators, simplifying field operations and reducing equipment complexity. Data and work-flow management for the system will exploit distributed messaging, cloud technologies for scalable processing, and be implemented using open source software.