

**Intellectual Merit:** We propose a three year, multiple-institution development project for the Square Kilometer Array (SKA), the next generation radio telescope for meter and centimeter wavelengths. The primary goals are to contribute to the design concept being prepared by the US SKA Consortium; to conduct site testing in the southwestern US; and to develop RFI (radio-frequency interference) mitigation techniques in the context of a science-driven project concerning detection of the epoch of reionization, when the universe was less than 1 billion years old. The end products will include (1) refereed publications on RFI mitigation algorithms and science results; (2) white papers presenting an SKA design based on a Large-N configuration of many small reflector antennas; and (3) white papers on southwestern US sites for elements of the SKA. White papers will be submitted several times in the 2003-2006 time frame to the International SKA Steering Committee (ISSC), which oversees the SKA project. The current goal is to select the design and the site for the SKA in 2007. Cornell University, as the lead institution for the NSF-funded effort, takes responsibility for consolidating and reporting the results of individual efforts from this and a related NSF project on SKA development.

The SKA will complement existing and planned telescopes that cover the entire electromagnetic spectrum. It will be the most capable but also the most complex array telescope ever built, with sensitivity 20 to 100 times better than existing instruments. It will uniquely probe the cosmic evolution of hydrogen through measurements of structure in the highly redshifted 21 centimeter spectral line. In other, radical new ways the SKA will help unveil the universe — from the solar system to the transient radio sky to the most distant and earliest epochs since recombination — as part of a comprehensive, multiwavelength enterprise.

**Broader Impact:** The SKA will impact all areas of astrophysics and will lead to revolutionary advances in our understanding of the universe and our origins within it. Leading up to the SKA, development work proposed here will provide significant opportunities for education and public outreach to broad audiences. Technology development will yield spinoffs that range from installation of single antennas in educational and science-center settings, to construction of arrays for spacecraft tracking and telemetry.

The SKA is an international endeavor coordinated through the ISSC, which includes US membership. The ISSC has adopted a development plan that targets convergence to a single design for the SKA by 2007. Additional development would continue through commencement of construction in 2010 with a target date for completion in 2015. The recent US decadal review<sup>1</sup> recommended participation by the US in the SKA project and funding for a technology development program.

Radically different designs for the SKA are being investigated in different countries. The US SKA Consortium's concept entails a large number of stations formed from about 3000 to 8000 small, parabolic dish antennas and organized into a configuration that optimizes scientific return. Significant technical challenges are posed because of the large number of replicated units and the enormous data rates. New signal processing, calibration and imaging algorithms are needed to exploit the redundancy inherent in the design and to mitigate radio frequency interference. The Consortium represents a broad spectrum of the US radio astronomy community and includes institutions having the will and expertise to carry out development studies.

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<sup>1</sup>*Astronomy and Astrophysics in the New Millennium*, National Research Council, 2001