The Status of the Five-hundred-meter Aperture Spherical radio Telescope and its Early Science Programs

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The Five-hundred-meter Aperture Spherical radio Telescope (FAST) is the only Chinese "mega-science" astronomy project currently under construction. First proposed as part of the SKA concept in 1994, FAST was approved by the national government in 2007 as a standalone project to realize the largest single-dish antenna in the world and to achieve 10% of SKA sensitivity. The construction phase started in March 2011 with an expected first light in September of 2016. The FAST project has six subsystems, namely, Site, Active Reflector, Feed Support, Receivers, Measurements and Control, and Observatory. By the end of 2013, the site surveying and restructuring have been finished with about 1 million cubic meters of earth removal. The design studies have finalized the engineering plans for panel installation, the contract of which was signed in November of 2013. The construction of 6 steel towers begun in late 2013. Six active cables connected to the upper platform of the feed-cabin will operate in combination with a Stewart platform, which has achieved 10 mm active control precision in dynamical simulations. The Measurements and Control subsystem realized a feed-cabin measurement RMS of 5 mm at 10 Hz sampling rate in 1:10 scaled experiments. The Receiver subsystem finished a demo of the L band receiver. A plan for multiple platform layouts in order to reduce the operating weight of the feed-cabin has been submitted. The Observatory subsystem actually started before the formal construction phase with the building of a 7 km road to the site. The sewage is being worked on.

The main foreseeable technical challenge in its commissioning and early phase of science operation is the precision control of the 30-ton focal-cabin/platform in 3D space. To produce significant science results while the performance is being improved, the FAST will be more effective in lower frequency range, targeting point sources that have clear characteristics in either time and/or frequency domain. A comprehensive review of these constraints in combination with the comparative advantages of FAST over Arecibo results are in three key early science projects: 1) pulsar searches in M31 and globular clusters; 2) OH mega-maser searches in infrared galaxies; 3) A spectroscopic line survey of the Orion nebular. We are quantifying the planning of these projects, including pipelines, observing modes, target lists, and expected detections. Substantial efforts are also spent toward examinations of recent science developments in the context of FAST capabilities. The current promising directions include studying "dark gas" and tracing the inter-galactic medium.