Sustaining Submillimeter Science in the Next Decade and Beyond

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Vigorous and transformative investigation of the millimeter/submillimeter sky at high sensitivity and high resolution has benefitted from the recent completionfive years of science from the Atacama Large Millimeter/submillimeter Array (ALMA). ALMA is a partnership of ESO (representing its member states), NSF (USA) and NINS (Japan), together with NRC (Canada), NSC and ASIAA (Taiwan), and KASI (Republic of Korea), in cooperation with the Republic of Chile. The Joint ALMA Observatory is operated by ESO, AUI/NRAO and NAOJ. ALMA, a versatile interferometric telescope at 5000m elevation in the Atacama Desert of northern Chile, is comprised of sixty-six precision telescopes which may be arrayed over a 16 km extent on the high Chajnantor plain. The ALMA system is dynamically upgraded–very long baseline capability is expected to bring microarcsecond imaging to a worldwide array anchored by ALMA with excellent potential for imaging nearby Black Holes on the scales of their Event Horizons. During the upcoming decade through 2030, new capabilities will expand ALMAs envelope of exploration even further. ALMA will complete its 35-950 GHz spectral grasp. The final receiver bands will be deployedBand 5 (164-211 GHz) is being commissioned now; receiver construction has begun for Band 1 (35-52 GHz) and a prototype has been constructed for Band 2 (67-95 GHz). Building on the successes of the initial suite of capabilities, ALMA will look to enhance its initial capabilities in several key areas in the 2030 decade. These include increased bandwidth (for increased sensitivity and spectral coverage), increased imaging speed (cameras / focal plane arrays), and higher angular resolution (longer baselines). The scientific thrust will include the ability for enhanced imaging of planetary disks, galaxy assembly, and chemical analyses of star-forming regions. An upgraded correlator is under study, which will enlarge the number of channels and increase resolution by 8x, while improving spectral sensitivity by employing more bits. When complemented with an upgraded digitization and frequency distribution system, also under study, the correlation capacity may be doubled to 8 GHz per polarization and sideband. Several ALMA receivers already present more bandwidth to the correlation than it can currently process; the Band 2 prototype, for example provides two 8 GHz sidebands in two polarizations. Other improvements are under way, (1) to the ALMA Archive: enabling gains in usability and impact for the observatory; (2) implementation of the longest baselines at the highest frequency, along with study of achieving longer baselines at lower frequency to match, and (3) increasing wide field imaging, to provide efficient wider area coverage. ALMA is developing a Roadmap for identifying the capabilities needed to address community science drivers for the coming decade, which will be discussed at the conference. The scale of the upgrades considered is that of a midscale project; ALMA plans to submit a white paper to the decadal review describing these proposed upgrades. **NRAO expects to issue a new Call for Proposals for Development Projects on 10 October 2016. End of January 2017 is the proposal deadline.**