Next Generation Very Large Array: science overview and Community Studies

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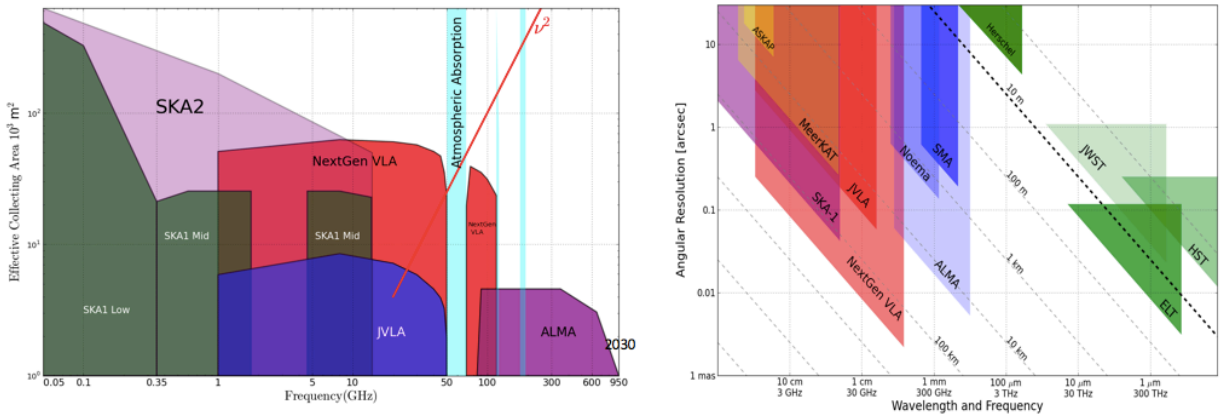
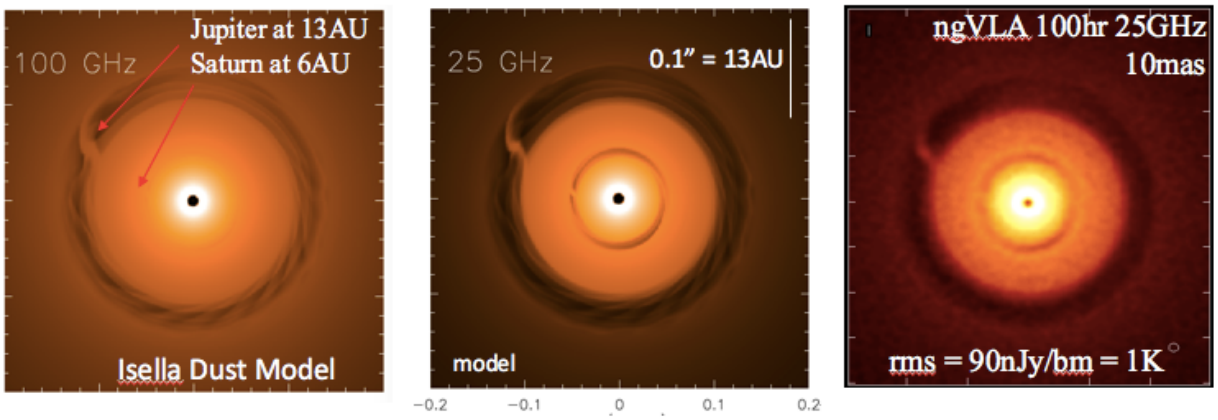
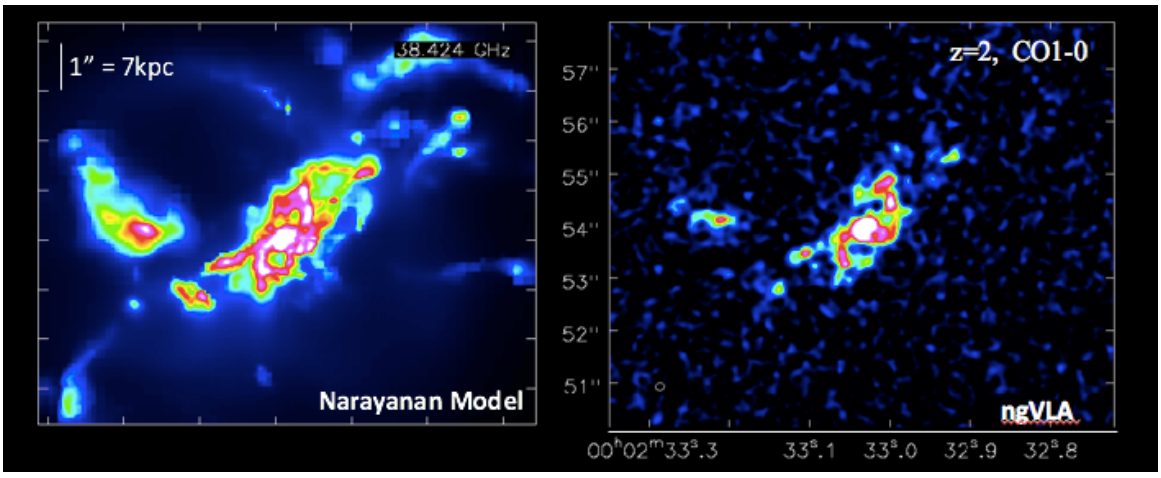
We will review the capabilities and some of the priority science goals of a next generation Very Large Array (ngVLA). We will then summarize the ngVLA community development projects that are currently underway. The ngVLA will be an interferometric array with 10 times larger effective collecting area and 10 times higher spatial resolution than the current VLA and ALMA, nominally operating in the frequency range from 1GHz to 115GHz. The ngVLA opens a new window on the Universe through ultra-sensitive imaging of thermal line and continuum emission down to milliarcecond resolution, as well as unprecedented broad band continuum polarimetric imaging of non-thermal processes. The continuum resolution will reach 9mas at 1cm, with a brightness temperature sensitivity of 6K in 1 hour. For spectral lines, the array at 1" resolution will reach 0.3K surface brightness sensitivity at 1cm and 10 km/s spectral resolution in 1 hour. These capabilities are the only means with which to answer a broad range of paramount questions in modern astronomy, including direct imaging of planet formation in the terrestrial-zone, studies of dust-obscured star formation and the cosmic baryon cycle down to pc-scales out to the Virgo cluster, making a cosmic census of the molecular gas which fuels star formation back to first light and cosmic reionization, and novel techniques for exploring temporal phenomena from milliseconds to years. The ngVLA is optimized for observations at wavelengths between the superb performance of ALMA at submm wavelengths, and the future SKA-1 at few centimeter and longer wavelengths. Project information, memos, and other documentation can be found at: *https://science.nrao.edu/futures/ngvla*



Parameter Space for the Next Generation VLA in context of current and future telescopes.



Theoretical model images of the thermal dust emission from a 1Myr old protoplanetary disk orbiting a Solar mass protostar, plus an ngVLA mock observation at 25GHz, with a resolution of 10mas = 1AU at 130pc (Carilli et al. 2016, ngVLA memo. 5; Isella et al. 2016, ngVLA memo. 6).



Theoretical model image of the CO 1-0 emission from a z = 2 forming galaxy, plus the ngVLA mock observation at 38GHz, 0.15" resolution (Casey et al. 2016, ngVLA memo 8).