

## The Long Baseline Major Option for the Next Generation Very Large Array

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The Next Generation Very Large Array (ngVLA) is the major new radio interferometry project concept being led by the National Radio Astronomy Observatory. The baseline design calls for almost continuous frequency coverage from about 1-100 GHz, with sufficient bandwidth to cover each receiver's full bandpass. Additionally, there will be improvements of a factor of about 40 in longest baseline, and 8 in number of antennas. The design is optimized for high angular resolution studies of thermal radio sources.

The same optimization for high frequencies is ideal for a variety of ultra-high angular resolution applications, mostly, but not entirely on non-thermal sources. High frequencies are ideal for observing flat-spectrum synchrotron sources, which tend to include the faintest accreting black holes. They are also ideal for avoiding scattering and scintillation for searches in the Galactic Plane.

To take advantage of these extra capabilities, the ngVLA needs to have the *Long Baseline Major Option* implemented. With this option, about 30 additional antennas will be spread over the United States, including some island sites. The improvement in sensitivity and field of view will allow for in-beam calibration for a large fraction of sources, making the ngVLA with the Long Baseline Major Option an ideal astrometric facility, with its capabilities optimized for classes of sources that Gaia cannot observe. A variety of astrometric applications exist given the potential for  $\approx 1$   $\mu$ arcsecond positional accuracy – mapping out the star formation of the Galaxy, measuring distances and astrometric wobble for stellar mass black holes, measuring proper motions of galaxies and of ejected active galactic nuclei. For imaging, it would be possible to resolve stellar photospheres, to make unique images of gravitational lenses, and study AGN jets in unprecedented detail. All of this work is currently either impossible, or severely sensitivity limited with the current Very Long Baseline Array.