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TRIALS OF OMNI-DIRECTIONAL SKY SURVEY TELESCOPES

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The SETI Institute, Ohio State University, and the Australia National Telescope Facility have begun to implement concepts for antenna arrays that form multiple simultaneous beams. These arrays synthesize outputs using digitized data from many low-cost, independent elements, using high-speed parallel processing hardware. Any particular data stream is approximately equivalent to the signal from a specific, analog hardware configuration, for example, a parabola aimed in a given direction.

If elements for the array are relatively small and mass produced, the total antenna cost becomes dominated by that of the computation, which is expected to decrease exponentially over the next two decades. Three antenna types are now being tested: modest sized phased parabolas, Luneburg lenses with multiple feed horns, and a flexible phased array with essentially omni-directional elements. In an interference free environment, one can form as many independent beams within an element primary as computing power will allow.

This is particularly interesting for SETI, which ideally desires observation of all the sky all the time. Vast numbers of small, omni-directional elements can be combined as computing power per dollar increases, with little increase in cost. Antennas comprising large numbers of small elements can perform deep surveys of the sky for SETI and conduct radio astronomy as well. However, omni-directional elements are small in area, and thus, larger collecting areas with more directional characteristics are being used in early phases of construction, while computing power is expensive.

In SETI, man-made interference is the principal impediment to a systematic survey of large numbers of stars. Primary methods of interference elimination, excision, nulling, and subtraction are now being modeled in the digital domain. Realistic simulations will be used to illustrate the differing merits of the three antenna types described above.