

Non Coplanar Radio Imaging Arrays and Computing Efficiency

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Abstract

The generation of radio interferometers currently coming on line will produce vastly more data than previous instruments and for the foreseeable future will be limited by the ability of astronomers to process the data. Furthermore, the remarkable increase in processor speeds over the last several decades is nearing an end and future improvements in computing power must be derived from some forms of parallel computing. These factors require a reevaluation of many of the current techniques which have been developed in a single threaded environment.

One of the serious problems needing addressing is the three dimensional nature of many radio synthesis arrays which use Earth rotation to increase the density of samples in spatial frequency space. This is generally referred to as the “w-term” problem where “w” is the spatial frequency coordinate in the direction of the target field. Celestial objects outside of the solar system can be considered to be at infinite distance, hence to lie on the celestial sphere. In this case, there is no actual resolution in the direction of the source but since the celestial sphere is curved, the problem becomes three dimensional. An efficient solution to this problem is discussed.