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# Development of a Distributed MIMO Meteor Radar Network for Space Weather Research

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## Extended Abstract

Meteor radars operate by reflecting a transmitted signal off of a meteor plasma trail and inferring properties of the meteoroid and atmosphere, including wind speed and direction, based on the returned signal. Traditional meteor radars estimate a mean wind covering a broad horizontal region as a function of altitude and time [1]. Recent developments in multiple-input multiple-output (MIMO) meteor radar networks have made higher-resolution wind measurements of the upper atmosphere possible [2,3]. These networks operate over coded continuous-wave links between separately-located transmitter and receiver sites to increase the density of specular meteor trail observations and provide diversity in sensing Doppler-derived wind projections. Such datasets contain enough information to estimate the three-dimensional wind field within the observation volume to a resolution limited only by the measurement density in space and time.

This paper presents an overview of a new project, funded under the US National Science Foundation Distributed Array of Small Instruments (DASI) program, to further develop instruments and techniques to produce a modular, expandable, production-quality MIMO meteor radar network. Testing and deployment will take place near the Rocky Mountains with a network consisting of two transmit array sites, one receive array site, and ten single-receiver sites providing observational coverage of upper atmospheric winds in a region spanning ~90,000 square kilometers. The project will encompass: hardware engineering, to optimize system design and produce a remote-deployable integrated receiver unit; software engineering, to create open source tools for radar operations, meteor detection and processing, and wind field estimation; and scientific analysis, to study the upper atmosphere in the Rocky Mountain region and measure the lower thermospheric wind field from a new mesoscale perspective.

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