

## Technical Page

Proposal Type: Regular  
 General Category: Terrestrial Aeronomy  
 Sub-Category: Radar  
 Observation Category: meteor  
 Total Time Requested: 50 Hours  
 Minimum Useful Time: 8 hours

**Proposal Title:** Common Volume Radar/Lidar Meteor Observations to Clarify Meteor Radio Science and Atmospheric Interaction Issues.

*ABSTRACT:*

We propose prototype common volume radar/lidar observations of meteoroids entering the atmosphere in the 85-120 km altitude region. This observation mode is possible only at AO. The radar observations are now standard, well documented, and will also utilize the one available interferometer leg. As the 430 MHz line-feed radar beam is approximately 300 m in diameter in the meteor zone, the sodium lidar beam will need to be expanded to approximately that diameter and the receive telescope suitably aligned and field-of-view adjusted. The lidar would be operated synchronously with the radar at the same IPP and raw data from each pulse would be retained for post-processing. While we do not know if lidar meteors are observable, there are sound scientific reasons for the observations. We have determined that some radar meteors disappear in a single IPP 1 msec. These are known as terminal events and they have been shown using the AO 46.8 MHz radar (that we also propose using) to produce a terminal "ball" of plasma larger than  $\hat{1}$ 7 cm in at least some cases. Observations at the Sondrestrom radar (1290 MHz) and at the Poker Flat AK AMISR radar (449.3 MHz) convincingly demonstrate that meteor head-echoes are due to at least two processes. The first is scattering from the electrons surrounding a solid body meteoroid that displays deceleration indicative of a micron-sized object. The second is scattering from very high deceleration events that, based on the Sondrestrom/AMISR comparisons, appear to be due to a highly fragmented body characteristic of a more slowly developing (over a few milliseconds) terminal event. Both kinds of terminal events may produce enough atomic sodium to be visible to the lidar in the proposed observations. If observed radar/lidar meteors would greatly enhance our knowledge of the radio/lidar science of meteor scattering and tell us much more about meteoroid interaction with the atmosphere.

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### Remote Observing Request

- Observer will travel to AO
- Remote Observing
- In Absentia (instructions to operator)

## Instrument Setup

47 CH receiver 47 radar 430 CH receiver 430 CH radar

### Atmospheric Observation Instruments:

Lidar

**Special Equipment or setup:** The sodium lidar will need to be beam expanded to  $\tilde{3}00$  m diameter at 100 km altitude. The receive system will need similar modifications with the whole system aligned to look in common-volume with the zenith linefeed beam. The lidar IPP must be synchronized with the 1 msec radar IPP with data readout every IPP over the meteor zone. All data will be analyzed off-line with largely production-level software. Some receive parameters are negotiable.

### RFI Considerations

### Frequency Ranges Planned