Meteor Detection With the HAARP VHF Radar

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In May 2001, a new VHF radar system was installed at the HF Active Auroral Research Program (HAARP) site in Gakona, Alaska. The radar transmitter is capable of operating from 135 to 143 MHz. However, from a practical standpoint, the radar is typically tuned to frequencies clear of interference. In this regard, 139.3 MHz is the most common transmission frequency. The radar antenna consists of an array of 32 × 24 collinear, coaxial dipoles. The maximum and minimum pulse widths are 2 milliseconds and 0.5 microseconds, respectively, and the maximum duty cycle is 10%. As currently configured, the radar employs sixteen transmitter modules to generate 40 kW peak power. The purpose of the radar is to monitor naturally occurring phenomena in the atmosphere/ionosphere above HAARP as well as modifications to the ionosphere brought about by the HAARP high-power, high-frequency modification facility. The first extended duration observation runs with this radar took place beginning in July 2002 and ending in September 2002. Although the radar observation program was optimized for the detection of Polar Summer Mesospheric Echoes, a rich variety of meteors were detected as part of the geophysical background. Many of the observations were made in the time frame of the Perseids shower (August 12), but observations at the peak of the shower were curtailed by a power blackout. Because the radar beam is directed vertically, meteor head echoes are most commonly observed in the main beam. However, strong meteor trails and perhaps geomagnetic field-aligned trails are detected through the sidelobes of the antenna. Meteors are commonly observed at ranges from 150 km to 450 km and beyond. In this presentation, we explore the plasma physics involved in meteor ablation in the atmosphere. Investigations indicate that the plasma processes can be quite turbulent depending on the size and nature of the meteor.