2011 Workshop: Meteors

Long title
Meteor Science: Upper Atmospheric Impacts
Conveners
Unknown
Description

Each day billions of meteoric particles undergo a dynamic evolution as they enter the Earth's atmosphere. The vast majority of these entering particles, referred to as meteoroids, evaporate completely in the upper atmosphere depositing mass, energy and an array of constituents. During the ablation process, these particles form a dense plasma around the meteoroid, known as a head-echo. This plasma evolves into a persistent trail of plasma that diffuses into the background atmosphere. This observed phenomena is a meteor. Meteors have been documented since ancient times and have been studied scientifically for well over a century, yet many outstanding questions remain. Basic characteristics such as the amount of material deposited into Earth's atmosphere, and meteoroid physical and astronomical properties are still debated. In addition, the impact of this incoming flux on upper atmospheric chemistry and ionization processes are still under investigation. Meteors are of significant value to the CEDAR community because meteors account for all of the dust, neutral metal and ionized particles in the upper atmosphere. They also provide a means to infer upper atmospheric winds and to a degree temperature via remote sensing techniques, which is a focus area of CEDAR researchers. Further, meteoric dust is also thought to provide the condensation nuclei for several MLT phenomena such as polar mesospheric clouds PMC (high altitude clouds near 80 km), which is the focus of a current NASA mission (AIM).

To address the outstanding questions currently under investigation in the field of meteor science, we invite presentations on the physics of meteors and their impact effects on the atmosphere and ionosphere, as well as engineering techniques for observing and characterizing the meteoroid population. We encourage presentations using any data set, i.e., lidar, radar, satellite, and optical, as well as theoretical modeling of meteoroid impact effects.

This year we will continue a panel discussion begun in 2009 on the following topic. " How do we make sense of non-smooth radar “light curves”?” and by extension “what are the implications of these atmospheric interactions on mass deposition and processes in the ionosphere?” This topic has been the result of a number of recent papers, and disagreement between different researchers. We look forward to a lively and informative discussion amongst panel and audience members.

Agenda

Introductions

Jonathan Fentzke: Agenda and Definitions (pdf)

Julio Urbina: Background and Radar Remote Sensing Overview (pdf)

Panel Discussion

John Mathews

Mike Sulzer (pdf)

Lars Dyrud (pdf)

Student/Individual Presentations

Freddie Galindo: “Light curves” observed on meteor-head radar returns from Jicamarca: Preliminary Results (pdf)

Elizabeth Bass: The Meteoroid Mass Distribution Observed at the Jicamarca Observatory

Robert Michell: Optical and Radar Meteor Observations at Jicamarca.

Meers Oppenheim: An Update on Non-Specular Trail Meteor Winds: Validation and Techniques (pdf)

Ryan Volz: Improving Radar Observations Using Compressed Sensing (pdf)

Justification

The workshop is justified/motivated by scientists and students actively involved in meteor science as well as related fields that rely on meteor observations to derive upper atmospheric parameters.

Summary

60+ Attendess [At Least: 26 Graduate Students, 4 Undergraduates, 26 Post-docs & Scientists]

This year we continued a panel discussion begun in 2009 on the following topic. " How do we make sense of non-smooth radar “light curves”?” and by extension “what are the implications of these atmospheric interactions on mass deposition and processes in the ionosphere?” This topic has been the result of a number of recent papers, and disagreement between different researchers. There was a brief introduction by Jonathan Fentzke and Julio Urbina to provide context and background for the panel. Then John Mathews, Mike Sulzer, and Lars Dyrud provided theory and data examples of simple ablation, fragmentation, differential ablation, and multiple scattering. After a lively discussion between panel members as well as questions and answers with the audience we moved on to student presentations by Freddie Galindo of PSU and then Elizabeth Bass at BU. Their talks covered new modeling and observational results from Jicamarca. Then Robert Michell of SWRI presented new combined optical/radio results on meteor trails at Jicamarca and Meers Oppenheim of BU presented updated results of winds derived above Jicamarca from non-specular trails. Lastly, Ryan Volz finished the session with a discussion about new data processing techniques that may allow improved determination of meteor properties. Unfortunately, the meteor session was limited to 2 hours so we were not able to accommodate all the students and researchers interested in presenting their research, but nevertheless the session was very fruitful.

View PDF