# Mathematical and Computational Challenges in Radar and Seismic Reconstruction

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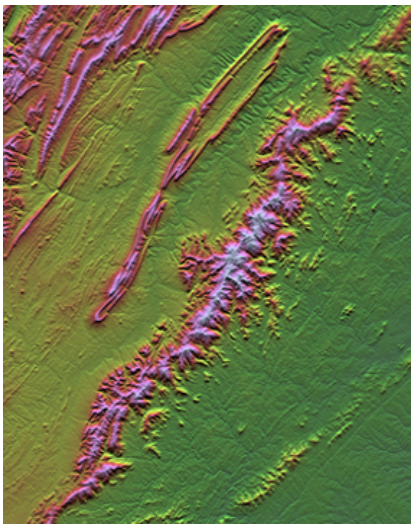
## Abstract


Inversion and imaging with waves is of fundamental importance in both radar and seismic reconstruction. Mathematics provides the key technology in both areas and, despite differing in many important respects, they have much in common in their underlying mathematical frameworks, approaches, and challenges. This semester program will focus on advancing their common mathematical and computational methodologies, as well as selected subjects distinct to each area, in the context of new challenges and opportunities that have arisen in recent years. Both theory and applications will be of interest. Participants will be drawn from academia, industry, and governmental laboratories in order to broadly address theory, applications, and their synergy.

The program will be influenced by recent developments in wave propagation and imaging, data acquisition and analysis, and high-performance computing. Driven by the ongoing need for more realistic mathematical models and simulations, recent advances in wave propagation and imaging in complex media are increasingly convincing and competitive but present new challenges. New sensor technologies have led to new types of data that can be collected, as well as to unprecedented volumes of data. This wealth of data offers new potential for gaining insights but also poses new needs for large-scale data-analysis algorithms that can effectively exploit advances in computing.

There is an outstanding opportunity to build on these developments and to bring the field to new levels of realistic inversion scenarios and problem scales. Topics to be considered in the semester program include wave propagation, inversion, and imaging in random media; statistical aspects of inverse problems, including homogenization and uncertainty quantification; optimization methods for inversion and imaging; large-scale computation and inverse problems, including methods for model reduction and large-scale optimization; and subjects of particular interest in radar reconstruction

**Synthetic aperture radar (SAR) image of Shenandoah National Park, Virginia, shaded relief colored by elevation, Shuttle Radar Topography Mission.**
**Image credit: NASA/JPL.**