

A Geospace Radar

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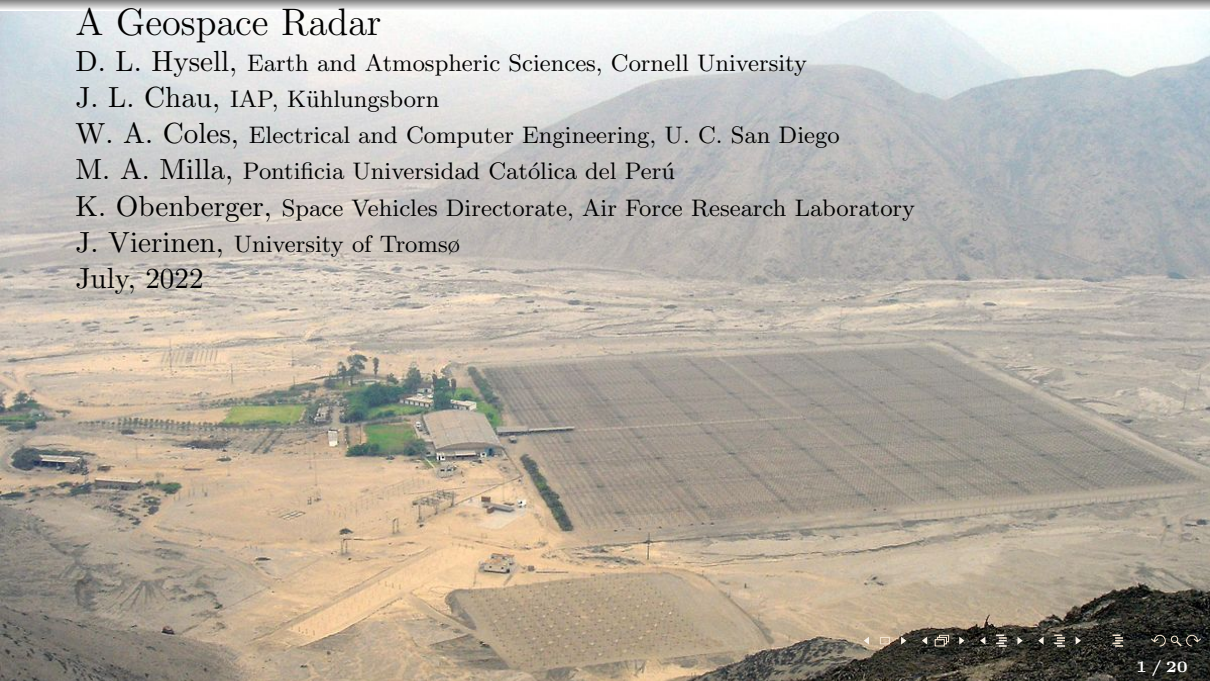
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- ▷ Workshop held at Cornell University March – April 1, 2015
 - Ultimately, workshop participants agreed that both basic and applied research with the facilities are essential. They should not be rank ordered. They should both be supported.
 - Workshop participants believe it will be important to re-balance experiment, theory, and modeling appropriately if we are to move toward the goals we have set for ourselves in our planning documents.
 - The workshop concluded that geospace science and engineering must begin to proceed collaboratively for progress to be made in the future.
- ▷ The case for combining a large low-band Very High Frequency transmitter with multiple receiving arrays for geospace research: A geospace radar. Radio Science, 54, 533 551. <https://doi.org/10.1029/2018RS006688>

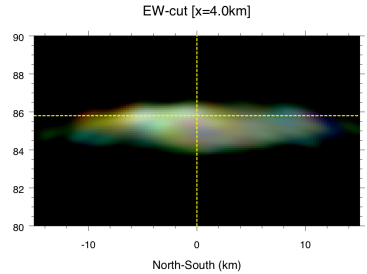
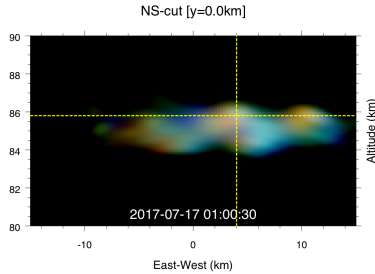
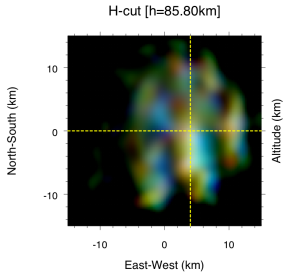
- ▷ Virtual workshop held under AGS guidance – April 26 – 28, 2021
 - The community should undertake the development of a new geospace facility, a geospace radar, following in the footsteps of contemporary, worldwide developments in radio astronomy and radar techniques.
 - It is imperative to train the next generation of scientists and engineers to take over ISR research and technology as an integral part of any next-generation facility.

(see https://landau.geo.cornell.edu/workshop_report.pdf)

- ▷ NASEM Decadal survey whitepapers due August 18, 2022

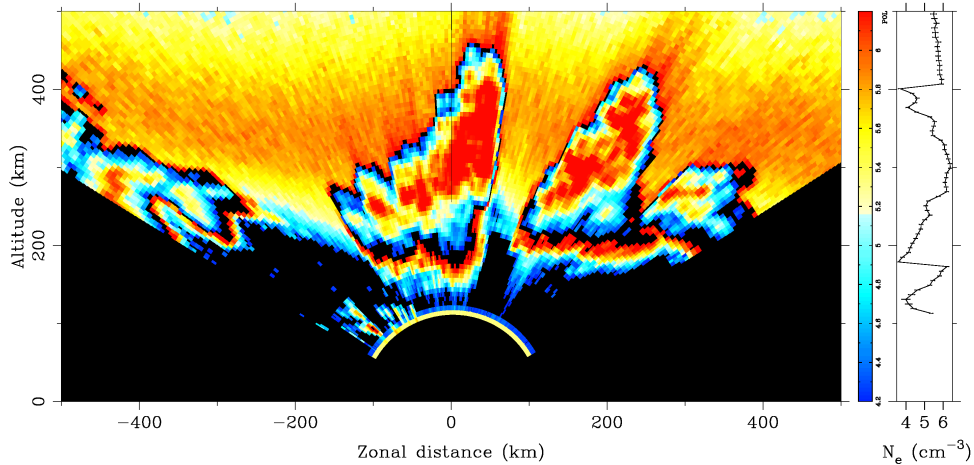
- 1 Cross-scale coupling
- 2 Data assimilation
- 3 Space weather
- 4 Neutral/plasma coupling
- 5 Mesospheric and lower thermospheric instabilities and mesoscale dynamics
- 6 Meteor science
- 7 Energetics, dynamics, transport
- 8 Planetary radar
- 9 Plasmaspheric radar
- 10 Solar echoes

- ▷ one or more phased array transmitters amid multiple pseudorandom radio array receivers (i.e. LWA, MWA, LOFAR type astronomical arrays)
- ▷ beamforming
- ▷ multistatic measurements (dynamics)
- ▷ spaced receivers for interferometry, imaging (super resolution)
- ▷ MIMO capability for wavevector diversity, full specification of flow fields
- ▷ frequency/ wavenumber diversity
- ▷ low-band capability (50 MHz)
- ▷ data center included

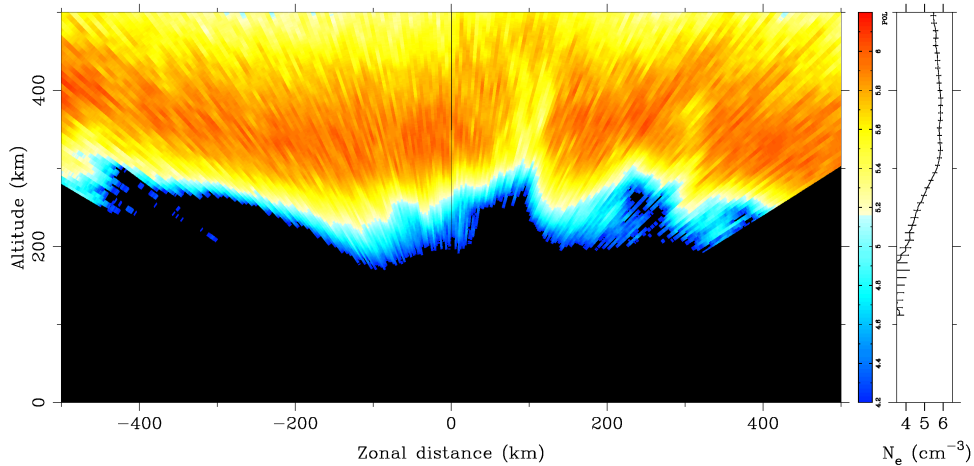


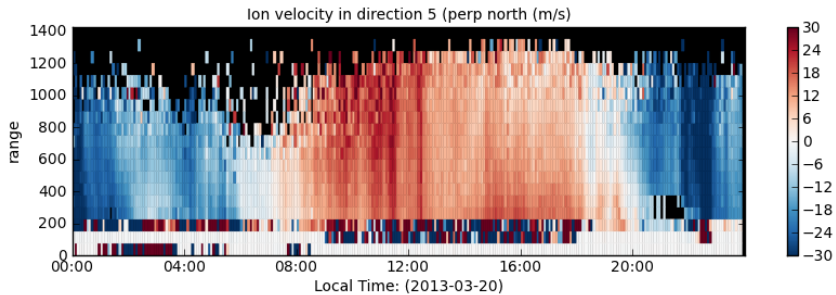
ionospheric irregularities

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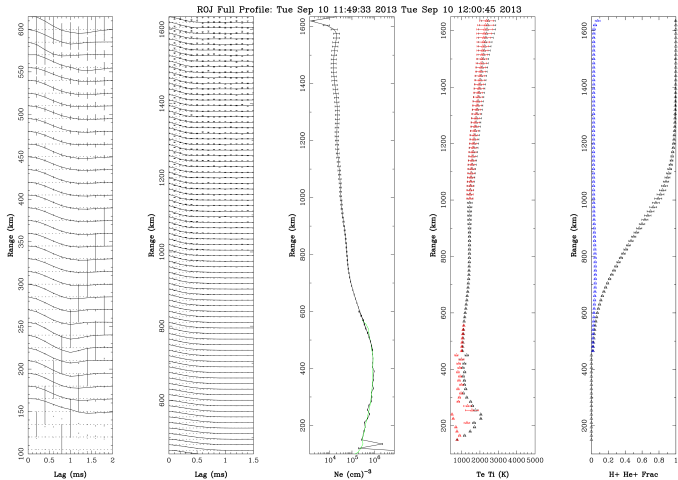


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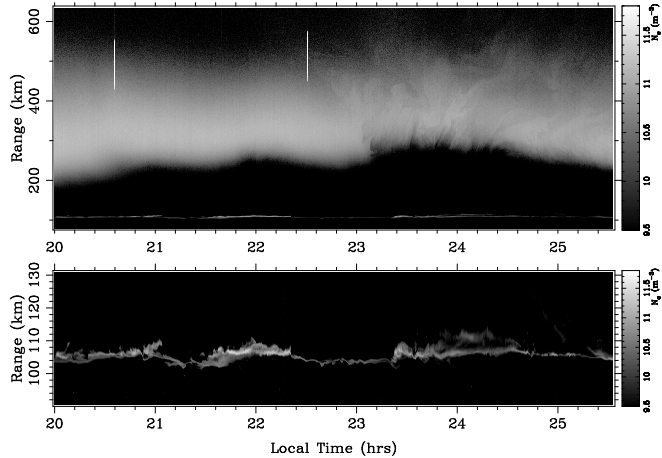




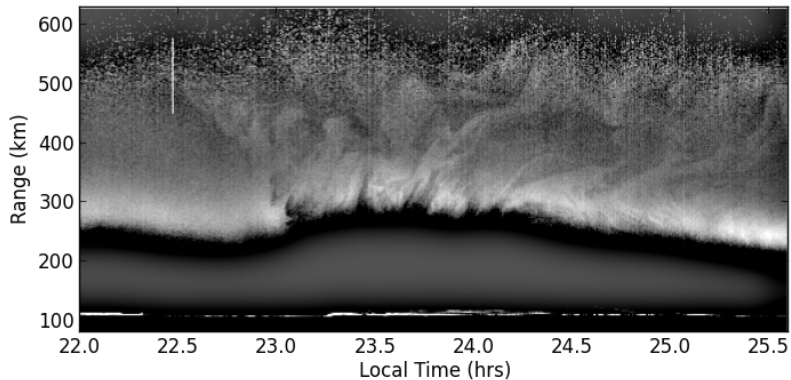
ionospheric state parameters



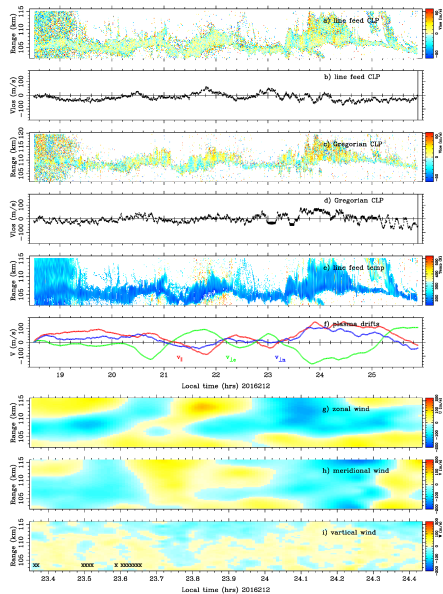
Arecibo World Day, July 30, 2016



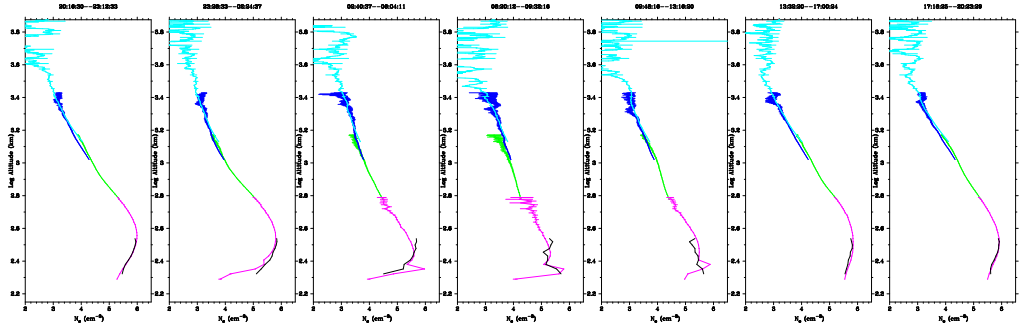
enhanced electron density RTI



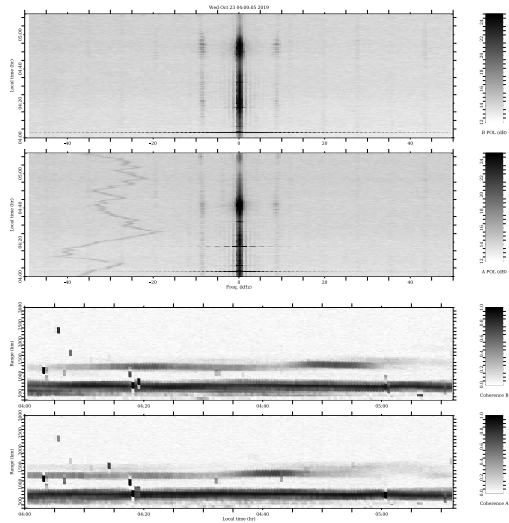
ionospheric drifts



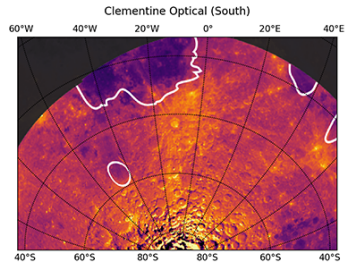
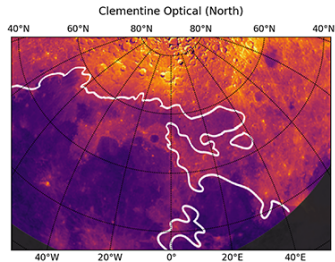
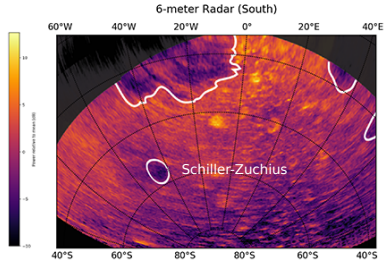
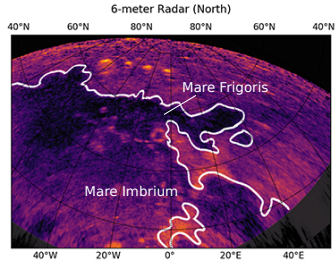
plasmaspheric density

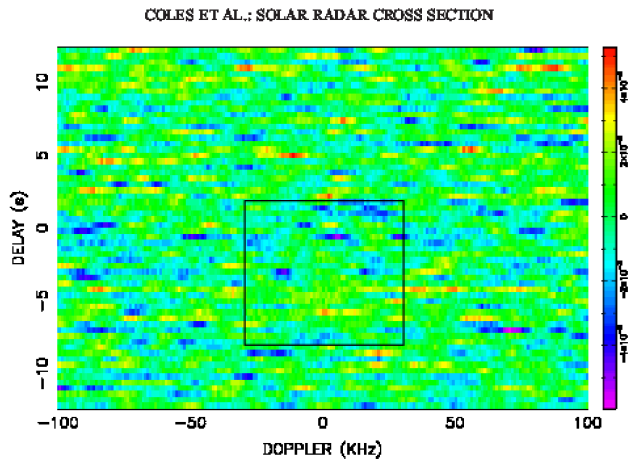


plasmaspheric waves



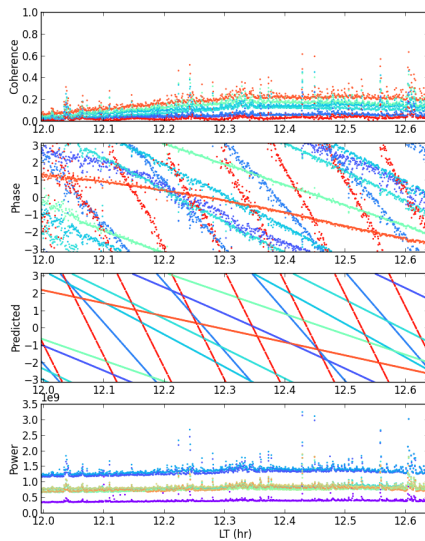
planetary radar





After W. A. Coles et al., *J. Geophys. Res.*, 111, A04101, 2006.

solar radio bursts



summary: radio array concept

- ▷ one or more phased array transmitters amid multiple pseudorandom radio array receivers (i.e. LWA, MWA, LOFAR type astronomical arrays)
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