2021 Workshop: Terrestrial Hydrogen

Long title
Hydrogen in the Upper Atmosphere
Conveners
Edwin Mierkiewicz
Description

Evaluating the distribution of hydrogen in the Earth’s atmosphere, and how that distribution responds to external forcing factors (e.g., solar activity), is important to our understanding of the mechanisms that shape the evolution of planetary atmospheres. Knowledge of this distribution can also guide atmospheric photochemical modeling of hydrogen containing species (e.g., CH4 and H2O), and be used for benchmark studies for these models. Further, hydrogen plays an important role in the mesosphere, thermosphere and exosphere as well as being the dominant species in the topside ionosphere. Hydrogen is also an indicator of whether our understanding of the processes near the turbopause is correct; the limiting flux of H into the thermosphere is established by the effective eddy mixing coefficient (Donahue, 1969). One of the most commonly used methods for investigating H from the ground is to use the H Balmer alpha line. Spacebased observations, such as those planned for the GLIDE and SIHLA mission, open new opportunities. Small optical remote sensing instruments on cubesats, commercial suborbital flight or other platforms will provide other insights. In this session we solicit contributions from the modeling and the observational community to address our current understanding, identify gaps / challenges, and establish a path forward. We look forward to contributions from across the entire spectrum of inquiry into hydrogen ranging from lower atmosphere exchange to plasmaspheric processes.

Agenda

Edwin Mierkiewicz — Introduction / The exosphere from the ground

Eric Sutton — Developing a coupled exosphere-thermosphere-mesosphere model

Jonathan Krall — The effect of the thermosphere exosphere on ionosphere outflows

Hyunju Connor — Exospheric neutral density near a subsolar magnetopause

Michael Chaffin — Hydrogen at Mars, the role of dust and escape

Lara Waldrop/Dolon Bhattacharyya — The Global Lyman-alpha Imager of the Dynamic Exosphere (GLIDE) Mission

Dmytro Kotov - The need in doubling of NRLMSISE-00 thermosphere hydrogen density is seen for the nighttime and daytime

Susan Nossal — Multi-decadal Hydrogen Variability

Justification

The ‘CEDAR New Dimension’ document highlights the upper atmosphere as a link between the atmosphere below and the interplanetary environment. Nowhere is this link stronger than in the exosphere/topside ionosphere where the terrestrial atmosphere literally merges with interplanetary space. As we explore the complex processes that govern the coupling, energetics, and dynamics of the upper atmosphere as a whole, our understanding of this important interface, through observations of its mean state and its response to external forcing, will provide important constraints as we seek to develop a complete picture of this complicated space-atmosphere system.

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