Contribution ID : **163** Type : **Short communications**

Fast Models of Multiple Lyman-Alpha Scattering for Exospheric Inversion

Lyman-alpha observations are widely used to study hydrogen exospheres. At high altitudes, measured intensity can often be approximated as proportional to hydrogen density integrated along the line of sight. At lower altitudes, the exosphere becomes optically thick, and absorption and multiple scattering produce a nonlocal relation between density and observed intensity. Full radiative-transfer calculations capture these effects, but their computational cost limits their use in inverse models requiring many forward evaluations.

We compare two approaches to reduce this cost. The first uses a surrogate model trained on high-fidelity radiative-transfer calculations. Rather than replacing the physical model, the surrogate predicts corrections to optically thin or single-scattering intensity caused by attenuation and multiple scattering. The second reduces the multiple-scattering operator itself using low-rank, reduced-basis, and simplified representations that preserve the main spatial coupling with fewer calculations. Both methods will be tested on the same asymmetric hydrogen distributions and viewing geometries. We will compare radiance errors, execution times, memory requirements, performance across optical depths, and sensitivity to density and temperature parameters. Our goal is to identify a fast, accurate radiative-transfer approximation suitable for retrievals of exospheric structure from Lyman-alpha images, including observations from the Carruthers Geocorona Observatory.

Primary author(s) : Mr HUAIRA LOPEZ, Isaac Leonardo (Universidad Nacional Mayor de San Marcos)

Co-author(s) : Dr CUCHO-PADIN, Gonzalo (NASA Goddard Space Flight Center); Dr ROJAS, Enrique (Observatorio Haystack - MIT)

Presenter(s) : Mr HUAIRA LOPEZ, Isaac Leonardo (Universidad Nacional Mayor de San Marcos)

Session Classification : ASTROFISICA Y CIENCIAS ESPACIALES