

**Bulletin of the American Physical Society****Fall 2021 Meeting of the Eastern Great Lakes Section**  
Friday–Saturday, November 12–13, 2021; Virtual; Eastern Time**Session J03: Oral Session 3**

10:15 AM–12:15 PM, Saturday, November 13, 2021

Chair: Bhubanjoyoti Bhattacharya, Lawrence Technological University

**Abstract: J03.00008 : Application of Monte Carlo Method to Simulate Radiation Transfer through Exoplanetary Atmospheres\***

12:00 PM–12:15 PM

[Preview Abstract](#)[← Abstract](#)**Authors:**Michael Rothman  
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(Ohio State University)**Collaboration:**

ExoMol, University College London

Development is underway of an exoplanetary atmosphere simulator Geant4-EXOPlanets (G4-EXOP) based on Geant4, a Monte Carlo program package enabling modeling of radiation and particle transmission through matter. G4-EXOP will be a toolkit to model host-star radiation transmission through atmospheric layers utilizing atomic and molecular data, allowing the comparison of observations with simulated spectra. We focus on atomic biosignatures (H, C, N, etc.) and molecules containing them (H<sub>2</sub>O, CO<sub>2</sub>, etc). Phosphorus is a focus as abundances in stellar systems are vital for DNA-based life. Atomic transition data are calculated using SUPERSTRUCTURE (SS), with phosphorus results reported. Utilizing molecular data obtained through ExoMol, we report computed oscillator strengths for H<sub>2</sub>O. We also report G4-EXOP filtered Gaussian convolutions of the solar irradiance and flux residual simulated spectra as a test. Following further development, we will simulate the flux residual and irradiance spectra of the Earth and Sun before simulating other star – exoplanet pairs. G4-EXOP will be a toolkit for modeling host-star radiation transmission through exoplanet atmospheres to characterize biosignature abundances within observations.

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