Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **3017** Type: **Oral Competition (Undergraduate Student) / Compétition orale (Étudiant(e) du 1er cycle)**

(U*) Earth-Like Stratospheric Clouds Do Not Impede Transit Spectroscopy with JWST

Wednesday 8 June 2022 15:30 (15 minutes)

The search to find habitable planets outside of our Solar System is made possible through the observational method of transit spectroscopy. Transit spectroscopy can help determine the chemical composition of an exoplanet's atmosphere. This is achieved by analyzing the light that passes through the upper atmosphere of the planet as it transits in front of its host star. Clouds significantly mute molecular features in transit spectra because they prevent light from probing the deeper layers of the atmosphere. High altitude aerosols are particularly problematic as they obscure more of the atmosphere. Most clouds on Earth form in the troposphere and hence do not significantly affect its transit spectrum: these deeper, denser layers of the atmosphere are opaque to transit spectroscopy in any case. Earth occasionally has stratospheric/high tropospheric clouds at about 15-20 km, suggesting that they could substantially limit the observable depth of the underlying atmosphere. We use solar occultations of Earth's upper atmosphere to create synthetic JWST transit spectra of Earth analogs orbiting dwarf stars. Unlike previous investigations, this work uses clear and cloudy sightlines from the Atmospheric Chemistry Experiment's Fourier Transform Spectrometer on the SCISAT satellite. The maximum difference in effective thickness of the atmosphere between a clear and globally cloudy atmosphere is 8.5 km at 2.28 microns. After incorporating the effects of refraction and noise, JWST would not be able to detect Earth like stratospheric clouds if an exo-Earth was present in the TRAPPIST-1 system, as the cloud spectrum only differs from the clear spectrum by a maximum of 10 ppm. To conclude, Earth-like stratospheric clouds will not impede JWST transit spectroscopy, and thus will not heavily impact the measured abundances of biosignatures of exo-Earths.

Primary author: DOSHI, Dhvani Chetan

Co-authors: Dr COWAN, Nicolas (McGill University); Prof. HUANG, Yi (McGill University)

Presenter: DOSHI, Dhvani Chetan

Session Classification: W3-10 Applied Physics I (DAPI) | Physique appliquée I (DPAI)

Track Classification: Technical Sessions / Sessions techniques: Applied Physics and Instrumentation / Physique appliquée et de l'instrumentation (DAPI / DPAI)