

## Oxygen Species and Thermospheric Airglow in The Earth's Sky (O-STATES): A Rocket Project on the O<sub>2</sub> Atmospheric Band

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Atomic oxygen and temperature are two essential parameters that determine the state of the thermosphere. The O-STATES rocket project is about quantifying the relationship between various oxygen species in the thermosphere and the airglow emissions that they give rise to. In particular, spectral analysis of the O<sub>2</sub> Atmospheric Band dayglow at 760-780 nm has been suggested as a measurement technique for thermospheric atomic oxygen and temperature. This approach has been advocated as a technique for thermospheric remote sensing under the name "Global Oxygen And Temperature (GOAT) Mapping". A central aim of our rocket project is a detailed evaluation of this technique and its potential use in remote sensing applications.

Our primary scientific questions are:

- Can recent laboratory results on the production and quenching of the excited oxygen species O(<sup>1</sup>D) and O<sub>2</sub>(b<sup>1</sup>Σ<sub>g</sub><sup>+</sup>) be confirmed by atmospheric measurements?
- Can spectral dayglow measurements of the O<sub>2</sub>(b<sup>1</sup>Σ<sub>g</sub><sup>+</sup> - X<sup>3</sup>Σ<sub>g</sub><sup>-</sup>) Atmospheric Band and the O(<sup>1</sup>D-<sup>3</sup>P) Red Line provide a comprehensive tool for characterising conditions in the lower thermosphere?
- What is the relative importance of neutral and ion-chemical pathways of thermospheric O(<sup>1</sup>D) production? How does this relate to ionospheric conditions?

The O-STATES rocket payload will carry instrumentation for daytime measurements of O(<sup>3</sup>P), O(<sup>1</sup>D), temperature, and charging conditions. Two launches of the payload to an altitude of 250 km are planned from Esrange, Sweden, in August 2015. They will probe geomagnetically quiet and disturbed conditions, respectively.