# Study of the Solar Atmosphere: Space Instrumentation and Observation


## Abstract

The Sun exhibits a complex atmospheric structure with temperature varying from $\sim 15 \times 10^6$ K at the core to ∼6000 K (∼6000 K) at the photosphere (chromosphere), and rising sharply again to $\sim 10^6$ K in the transition region and the corona. The chromosphere and transition region (TR), which lie between the photosphere and the corona, play a vital role in solar dynamics, being key indicators of solar activity and magnetic field interactions. While traditional chromospheric studies have relied on the Ca II H & K and H$\alpha$ spectral lines, the Mg II h & k lines offer a more sensitive diagnostic due to magnesium's greater abundance. However, atmospheric absorption hinders solar observations in the 200–400 nm near-ultraviolet (NUV) range— including the Mg II lines— and requires space-based instrumentation.

The Solar Ultraviolet Imaging Telescope (SUIT), on board the Aditya-L1 mission, performs spatially resolved full-disk as well as partial disk imaging of the Sun within the 200–400 nm band. With eleven science filters, *SUIT* probes the solar photosphere and chromosphere at various heights to understand the mass and energy transfer mechanisms between its layers. For the first time, *SUIT* also measure spatially resolved solar spectral irradiance at this wavelength band, which is significant for studying the Sun–climate relationships.

This thesis presents the characterization of the science filters of *SUIT*, the optical alignment and integration of the instrument, end-to-end photometric and spectral validation, followed by ground-based and in-flight tests and calibration. *SUIT* opens new window in solar astronomy observations, and the technology and methods documented here will be significant for the development of similar ground and space-based instruments in the future.