In Situ Spectroscopy at the Martian Surface – Modelling and Future Instrumentation

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As part of ESA's Aurora programme the ExoMars mission plans to send a descent module containing a rover and a long term base station to the Martian surface in 2011. Included in the instrument package of this rover will be a miniature spectrometer, currently in development, functioning within the UV and visual wavelength regime. This instrument will be used to quantify *in situ* for the first time the UV spectrum at the Martian surface, both directly through the atmosphere and also as reflectance spectra from the Martian surface. It is hoped that through analysis of these spectra it will be possible to characterise the hitherto unknown optical properties of the dust suspended in the Martian atmosphere. Computer modelling of the radiative transfer process through the Martian atmosphere will play an important role in the testing and calibration of the spectrometer. It is planned to create a multi-layered model of the atmosphere through which the equations of radiative transfer are solved by means of the iterative fitting of a delta-Eddington approximation algorithm. It is also intended to incorporate Martian atmospheric phenomena in order to simulate the functioning of the spectrometer under conditions such as CO_2 cloud cover or sky obscuration through the action of dust storms or dust devils. Study and characterisation of the Martian atmosphere and its attenuation of this region of the electromagnetic spectrum also has important astrobiological implications, such as quantifying the levels of UV insolation at the Martian surface with regard to life surviving under such conditions. It is envisioned that the planned computer model should be an ideal tool for simulating the incident radiation over repeated Martian orbital cycles in order to test the suitability of suggested habitable environments. With human exploration of Mars anticipated for the future, the ability to measure and predict the levels of potentially hazardous radiation a manned mission would encounter is imperative.