Abstract

The search for the presence of water and organic matter in small solar system bodies, which are considered to be important contributors to the origin of life on Earth, is still one of the main motivations of the composition research of interplanetary bodies. The hydrogen (H) and cyano radical (CN) emissions in meteor spectra present potentially the most suitable markers of H_2O molecules and organic compounds in meteoroids. In this work, we first investigate the presence of the Hα line and CN molecular band in a dataset of 22 high-resolution Echelle spectra from a wide range of laboratory tested meteorites of asteroidal materials. We used the plasma wind tunnel at the Institute of Space Systems at the University of Stuttgart, which reproduces the atmospheric entry-like heating conditions of incoming meteoroids to improve the methodology of determining the meteoroid composition from ground-based observations. This analysis aims to examine the presence and relative intensity of both emissions in different meteorites to demonstrate the variations of water and organic content in particular meteorite types with validation based on the known meteorite composition. Next, following analysis of laboratory data, we investigate the recognition of H and CN emissions in a large dataset of meteor spectra from mm to dm-sized meteoroids captured by the AMOS (All-sky Meteor Orbit System) network. This work aims to examine the dependency of H emission on orbital origin, atmospheric and material properties of meteors using the relative intensity of the investigated line, orbital and atmospheric parameters of meteors, to evaluate variations of water and organic content in different interplanetary materials in the solar system. The analysis of CN emission aims to determine the detection limits for this molecule in meteor spectra given the currently achieved resolution of the high-resolution AMOS-Spec-HR spectrograph.

Keywords: meteor, meteorite, spectroscopy, astrobiology