Development of the hydrogen absorption cell imager for observation of planetary coronas

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Hydrogen atoms in the planetary exospheres resonantly scatter the solar H Lyman-alpha radiation (121.567 nm) and form planetary hydrogen coronas. By measuring this emission, a density distribution of the hydrogen atom can be estimated. An absorption cell technique is an efficient tool for remote sensing of the planetary coronas and can measure not only density but also temperature distributions. These distributions give us crucial information to estimate quantitatively the escape rate of hydrogen atoms from the present planetary atmosphere. Furthermore, the technique could be suitable for future missions with ultra-small spacecraft because of its smallness, lightness, and simplicity. The performance of the absorption cell is strongly dependent on parameters such as filament shape, applied power, infill gas density, optical path length, and beam path of incident light. New hydrogen absorption cells have been developed for optimization of these parameters, and dependences of their performance on the parameters have been evaluated using an ultra-high spectral resolution Fourier transform spectrometer installed at the DESIRS beamline of Synchrotron SOLEIL in France. From the results of experiments, we have confirmed that the filaments should be thin and that the appropriate gas pressure and applied power should remain, respectively, in the range 100-300 Pa and 1-3 W. In addition, the new cell can be constructed with a weight less than 2 kg including electronics and in an outer envelope smaller than 2U (1U = 10 x 10 x 10 cm^3). Such a compactness is suitable for ultra-small space missions. However, further evaluations of the performances are required. In this presentation, the remaining issues and the current status of the development are presented.