Optimization of the hydrogen absorption cell dedicated for ultra-small missions

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Hydrogen absorption cell measurement is an efficient technique for remote sensing for the density and temperature distributions of the planetary hydrogen coronas. The temperature distribution gives scientists crucial information to estimate quantitatively the escape rate of hydrogen atoms from the present planetary atmosphere. In addition, the absorption cell technique has some advantages over others from the point of view of geometrical size, weight, simplicity, and durability. Thus, the technique could be suitable for future missions with small size satellites. An absorption cell photometer was mounted on the first Japanese Mars mission, NOZOMI, but no data could be obtained because NOZOMI’s orbit insertion was unsuccessful. The parameter optimization (i.e., filament shape, applied power, gas pressure, and so on) for the absorption cells installed in NOZOMI was insufficient due to the limited development time. Since the absorption performance is strongly dependent on these parameters, further optimization and study would be required for future space missions. We have developed new cells and evaluated dependences of the performances of them on 1) filament shape, 2) filament temperature, 3) hydrogen gas pressure, and 4) path length in the cell. In this presentation, we will present the current status of the optimization.

Keywords: planetary corona, Lyman-alpha, D/H ratio

