Identification of a UV absorber in the Venus atmosphere by FUJIN

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Ground-based optical telescopes have been used for astronomical observations, however, they have the following problems. Absorption by the ozone layer makes it impossible to observe wavelengths shorter than 300 nm. A continuous observation of an celestial object for a long period is difficult, unless multiple observatories with equal performance and longitudinal separation are available. Optical seeing is a measure of deterioration of spatial resolution due to atmospheric fluctuation, and spatial resolution for a ground-based observation usually cannot reach the diffraction limit. Therefore, observations from space platforms such as airplanes, artificial satellites and balloons have been developed. Satellite telescopes are free from influence by the earth's atmosphere. However, they are quite expensive, and in-orbit service for maintenance is almost impossible. A balloon-borne telescope has been proposed to overcome such disadvantages of the ground-based and satellite observations.

FUJIN-2 is a project to study phenomena in the planetary atmospheres and plasmas by an optical telescope suspended by a balloon up to the polar stratosphere at an altitude around 32 km. FUJIN-2 can observe planets for a long continuous period in a wide wavelength range without the seeing problem. Seeing is expected to be 0.1”” or less at that altitude, smaller than the diffraction limited spatial resolution of a visible telescope with an aperture of 1 m. Since FUJIN-2 floats above the peak density of the ozone layer, it is possible to observe wavelengths of 280 nm by FUJIN-2. Planets can be continuously observed for a long period especially from the polar stratosphere. On the other hands the balloon-borne telescope has a disadvantage that its launch depends on the weather condition. We regard that the above merits of the balloon-borne telescope surpass those of the other observation platforms even the disadvantage of balloon observation is admitted.

Venus is covered with thick sulfuric acid ($H_{2}SO_{4}$) clouds throughout the altitude range of 45-70 km. The cloud layer, not the ground surface, absorbs solar radiation and heats the atmosphere. At an altitude of 64 km, 50% of the solar radiation is scattered and absorbed [Tomasko et al., 1980]. The Venus atmosphere also has a special general circulation called as a super rotation, which circulates the entire planet to the west. The wind speed of the super rotation reaches 100 m/s at an altitude of 70 km, 60 times faster than the rotation speed of the solid body.

Attempts to reproduce the high velocity wind by numerical models are indispensable approaches to theoretically explain the super rotation, and so far a large number of studies have been carried out. However, understanding about the solar heating is insufficient, making it difficult to build a sophisticated model which reflects the realistic solar heating and distributions of chemical species. The main reason for this is that an absorber of a broad absorption band in the wavelength range of 320 - 500 nm is still unidentified. The ultraviolet absorption band for the wavelength region shorter than 320 nm is well explained by absorption due to SO_{2} centered at 283 nm. However, the absorption in the wavelength region longer than 320 nm cannot be explained by SO_2. Absorbing materials containing S (sulfur) have been proposed to explain the absorption in these several decades. Recently, it is shown that S_2O or OSSO are the most promising candidates for reproducing the edge of the absorption band at 400 - 500 nm. However, because the wavelength resolution of the spectral observation in the past was about 4 nm, the characteristic absorption structures of S_2O and OSSO could not be resolved. Therefore, observation by a spectrometer with a wavelength resolution higher than 0.4 nm is proposed for the main target of FUJIN-2. A test spectroscopic observation of Venus from the ground has been prepared, and the results will be presented.