Quantification of oxygen isotope ratios in the Venus atmosphere and detection of SO a-X 1.7 um airglow

Naomoto Iwagami[1]; Shoko Ohtsuki[2]; Seiko Takagi[3]; George Hashimoto[4]; Severine Robert[5]
[1] Earth and Planetary Science, Univ of Tokyo; [2] Senshu Univ.; [3] Earth and Planet Sci, Univ of Tokyo.; [4] Okayama Univ.; [5] Belgian Institute for Space Aeronomy, Brussels, Belgium

The oxygen isotope ratios $^{17}O/^{16}O$ and $^{18}O/^{16}O$ in the solar system are known to show a clear systematic relation. And the relation differs planet by planet. For example, the $^{17}O/^{16}O$ ratio as a function of $^{18}O/^{16}O$ ratio in Mars appears to be larger than that in the Earth-Moon system by 0.05 %. This fact indicates that the proto-Earth-Mars matter was so well mixed but with a systematic difference. In such a way, the isotope ratios may provide information about the origin and evolution of the planets. However, $^{17}O/^{16}O$ ratio in Venus has never been quantified, and may provide further information about the mixing history of the early solar system if measured.

The ratios may be quantified by ground-based CO_2 IR spectroscopic measurements. By assuming a use of IRTF CSHELL spectrometer with a nominal resolution of 40000, we looked for suitable wavenumber regions to quantify the $^{17}O/^{18}O$ and $^{18}O/^{16}O$ ratios. The suitable region for the former is found at 2648 cm^{-1} as shown in the figure, and the latter at 4582 cm^{-1}. In the figure, the top two curves show the earth and solar structures disturbing the quantification, and the middle two curves show the Venus $C^{17}O^{16}O$ and $C^{18}O^{16}O$ structures indicating a feasibility to quantify the $^{17}O/^{18}O$ ratio.

The SO a-X 1.7 um airglow may be expected if sulfur compounds present enough to react with O atoms to produce excited SO_x compounds. Appearance of such airglow indicates that the missing source of incredibly large SO and SO_2 abundance found by SPICAV spectrometer on board Venus Express at around 90-100 km seems to be sulfur compounds rather than H_2SO_4 + H_2O cloud sols. Ground-based measurements were performed at 5858 cm^{-1} with the CSHELL spectrometer pointing at around the anti-solar point of the Venus nightside where the airglow is expected to be most intense if the excitation mechanism is similar to that of the O_2 airglow.