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Quantification of oxygen isotope ratios in the Venus atmosphere by IR spectroscopy

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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.