

## Current status of data analysis of Venusian middle atmosphere observed by ALMA/ Synergy mission with Venus climate orbiter "Akatsuki"

\*Ryosuke Aoki<sup>1</sup>, Kazuki Tokuda<sup>1,4</sup>, Hiroyuki Maezawa<sup>1</sup>, Makoto Taguchi<sup>2</sup>, Tetsuya Fukuhara<sup>2</sup>, Hideo Sagawa<sup>3</sup>, Kazuya Saigo<sup>4</sup>, Yeon Joo Lee<sup>5</sup>, Takao M. Sato<sup>5</sup>, Masato Nakamura<sup>5</sup>, Takeshi Imamura<sup>6</sup>

1. Osaka Prefecture University, 2. Rikkyo University, 3. Kyoto Sangyo University, 4. National Astronomical Observatory, 5. Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency, 6. The University of Tokyo

For understanding of the origin of the short-term changes (several days/months) of CO mixing ratio in the Venusian middle atmosphere observed by the ground based millimeter wave band 10 m Telescope, SPART, it is essential to research the link between the atmospheric chemistry and dynamics in Venus. For this purpose we carried out the synergetic observations with Atacama Large Millimeter/submillimeter Array (ALMA) and Venus climate orbiter, Akatsuki.

In November and December 2016 and May 2017, we carried out the target of opportunity observations of CO and <sup>13</sup>CO at 200 GHz band (Band 6) and CO, <sup>13</sup>CO, HDO, SO, and SO<sub>2</sub> at 300 GHz band (Band 7) with ALMA synchronizing the fifty 12 m antenna arrays and Atacama compact arrays (twelve 7 m antenna arrays and four 12 m single dish antennas) to fulfill the coverage of UV plane. The spatial resolutions for the Band 7 and Band 6 under the C40-4 antenna configuration are 0.43 and 0.63 arcsec, respectively. The Voigt line shapes of the spectral lines obtained by ALMA give us the 3D information (longitudinal, latitudinal, and vertical distributions) of the minor constituents and the wind velocity of the Venusian middle atmosphere. On the other hand, by using the infrared and ultra-violet band cameras of Akatsuki the dynamics and chemistry in the H<sub>2</sub>SO<sub>4</sub> cloud region and troposphere can be traced. At present, the ALMA data is being processed by the semi-interactive analysis for the quality assurance procedures (QA2) in Joint ALMA observatory and East Asian ALMA Regional Center, and some data observed by 12 m and 7 m array were already delivered. By performing the band-pass correction and clean process of the delivered data set, we could obtain the 3D maps of <sup>12</sup>CO, <sup>13</sup>CO and SO and the maps of wind velocity, successfully. The maps show their day and night inhomogeneous distributions. For further reliable analysis, we will have to wait for the delivery of the TP array data set which allows us to calibrate the spectrum and to validate the missing flux effects. In this conference we will present the current status of the above analysis of the ALMA's data.

Keywords: Atacama Large Millimeter/submillimeter Array (ALMA), Venus Climate Orbiter "AKATSUKI", Venus, Atmospheric Gravity Wave, SPART Telescope, Planetary Atmosphere