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# Distributions of the Venus 1.27-micron night airglow and the rotational temperature

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In 1975 the Venus 1.27-micron $O_2$ airglow on both the dayside and the nightside was discovered by Connes et al. (1979), then the behavior of the night airglow has been investigated by ground-based observations. Allen et al. (1992) observed enhancements around the anti-solar point with some shift towards the dawn terminator. Crisp et al.(1996) found dramatic spatial and temporal variations of more than 20% only in one hour. Since the spatial variations of $O_2$ night airglow resemble those of NO night airglow, the standard scenario for $O_2$ airglow based on the case of the NO airglow (Bougher et al., 1990) was proposed; the oxygen atoms generated by the UV photolysis of $CO_2$ in the dayside upper atmosphere are transported to the night hemisphere, and recombine to form excited oxygen molecules at around 94km in downwelling (Allen et al., 1992). The shift of the bright region toward the dawn suggests a drag effect by the super-rotation in the thermosphere, and the rapid change may be due to modulation by gravity waves coming from the lower atmosphere. On the other hand, the 1.27-micron airglow intensities found in previous observations were so large that it needs all oxygen atoms generated on the dayside, and has not yet been explained well by models (Crisp et al., 1996). As described above, $O_2$ airglow has been used as a probe for chemistry and dynamics in the Venus upper atmosphere. But the observed datasets aren't enough to confirm the suggested models. In this study, several observations of the Venus 1.27-micron $O_2$ night airglow were conducted and the airglow intensity distributions and the rotational temperature distributions were obtained.

We carried out ground-based observations of the Venus 1.27-micron $O_2$ airglow from 2002 to 2006. Spectral image cubes were taken with Okayama Astrophysical Observatory/infrared imaging spectrometer (superOASIS), with the Gunma Astronomical Observatory/near-infrared camera and with the NASA's Infrared Telescope Facility/cryogenic echelle spectrograph (CSHELL). Spectral resolutions of the spectra observed at OAO and GAO were ~1,000-1,500, and the spectra show the features of O2 airglow, thermal emission, stray light from bright dayside. Each component was calculated using HITRAN and HITEMP which are molecular spectrum databases, VIRA1985 which is an empirical model of the Venus atmosphere, and US Standard Atmosphere (1976). The contributions of the three components and the rotational temperature were determined by optimizing the synthesized spectrum. On the other hand, spectral resolution of obtained at IRTF was ~40,000, with which each rotational line was resolved. From slopes of the Boltzmann plot, the rotational temperatures were determined.

The brightest airglow features were found at around the anti-solar point, which agrees with previous studies. And spatially resolved rotational temperature maps on the nightside hemisphere were also derived. They have some hotter regions which seem to overlap with bright regions.The temperature shows weak positive correlations with the airglow intensity. The bright retion may be heated chemically and/or dynamically, and supports the existing scenario for the Venus $O_2$ airglow. That is, the airglow is excited by the descending oxygen molecules which are transported from the dayside. But this result indicates the brightness of the airglow also depends on some other mechanism.