PPS03-P03 会場:コンベンションホール 時間:5 月 24 日 17:15-18:30

惑星大気のミリ・テラヘルツ帯へテロダイン分光ための超伝導検出素子の開発
Development of superconducting detectors for mm/THz band heterodyne spectroscopy of planetary atmospheres

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We are developing quantum noise limited detectors employing SIS(superconductor-insulator-superconductor) junctions and superconducting HEBs (hot electron bolometers). These detectors function as heterodyne receivers for millimeter-wave and terahertz frequency bands, which allow us to research planetary middle atmospheres with high frequency resolution (f/df = ~10^{6-7}). Retrieval analysis of the observed spectral lines provide us important information about atmospheric dynamics, vertical distribution of minor constituents and temperature, and so on.

We have promoted SPART (Solar Planetary Atmosphere Research Telescope) project developing a 10-m single dish ground-based telescope equipped with a low noise 100 GHz band SIS receiver. In 2011 we have just started test regular monitoring toward the middle atmosphere of Mars, Venus, and gas-giant planets to study the influence of solar activities on their atmospheric environment (Moribe et al. in this conference). For this mission we are additionally designing highly sensitive 230 GHz band SIS detectors with high linearity performance by newly optimizing novel tuning circuits and array junctions. By spectroscopy for different transition lines at these two frequency bands (e.g. CO J=1-0, 2-1), we will be able to derive the physical parameters with retrieval analysis more accurately, and perform line survey observation efficiently.

Broadband 1-2 THz band HEB mixer detectors have been also developed for the 30cm-telescope (Tsukuba Univ.), NANTEN2 (The Univ. of Tsukuba), and BSMILES(balloon-borne sperconducting submillimeter-wave limb-emission sounder (NICT)) so on, which allow us to observe various lines of key atmospheric minor constituents including fine structure lines of atoms and ions and rotation-vibration lines of such as OH radical with high frequency resolution. Improve the sensitivity and bandwidth of the detector we are currently optimizing the length and thickness of NbTiN nano-bridge by using a scanning electron beam lithography system and an original multiple sputtring/deposition system, and performing test heterodyne measurements.

we will present these current status.

キーワード: 惑星大気, ヘテロダイン分光, ミリ波/テラヘルツ波, 超伝導検出素子, 地上電波望遠鏡
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