

High-Sensitivity Terahertz Detection Module (HSTDM) onboard China's Space Station

Sheng-Cai Shi^{1,2} with HSTDM team

The Terahertz (THz) regime is of particular interest in astronomy as one can observe radiation from early distant, cold, and dusty objects, which are mostly invisible in the optical/NIR regime. It, however, is still a frequency band to be fully explored as water vapor renders the terrestrial atmosphere opaque over nearly all of the Earth's surface. China is going to launch a space station around 2022, providing a good opportunity for the development of China's space astronomy. And there will be a 2-m optical telescope flying simultaneously with the space station in common orbit. Five astronomical instruments including high-sensitivity terahertz detection module (HSTDM) have been selected onboard the 2-m optical telescope facility. The HSTDM, focusing mainly on the observations of neutral carbon (C I) and other molecular lines for the understanding of star formation, is mainly a 500-GHz niobium-nitride (NbN) superconducting-tunnel-junction (SIS) heterodyne receiver [1] operated at a temperature of 8-10 K, which is provided by a closed-cycle 2-stage pulse-tube cryocooler [2]. In addition, the possibility of adding a THz Schottky receiver onto HSTDM is taken into account. Detailed designs and testing results will be presented.

REFERENCES

- [1] Jing Li et al., "Low-noise 0.5 THz all-NbN superconductor-insulator-superconductor mixer for submillimeter wave astronomy," *Appl. Phys. Lett.*, vol. 92, pp. 222504-1/3, 2008, 10.1063/1.2940235.
- [2] Jia Quan et al., "4 K high frequency pulse tube cryocooler used for terahertz space application," *Chin. Sci. Bull.*, vol. 59, pp. 3490-3494, 2014, 10.1007/s11434-014-0457-5.

¹ Purple Mountain Observatory, Chinese Academy of Sciences, Nanjing 210033, China.

² Key Lab of Radio Astronomy, Chinese Academy of Sciences, Nanjing 210033, China.