# 共焦点受光光学系を用いた低温 THz 近接場顕微鏡の開発

## Development of low-temperature THz near-field microscopy with a confocal optics

東大生研[1]，東大総文[2] ○林 冠廷[1]，翁 銭春[1]，金 鮮美[1]，小宮山 進[2]，梶原 優介[1]

Univ. Tokyo, Kuan-Ting Lin, Qianchun Weng, Sunmi Kim, Susumu Komiyama, and Yusuke Kajihara

E-mail: kuanting@iis.u-tokyo.ac.jp

Passive THz Scattering-type scanning near-field optical microscopy (s-SNOM) without any external light source provides nanometer spatial resolution to probe fluctuating electromagnetic evanescent waves induced by fluctuating charge/current below the sample surface [1,2]. For expanding the application of the passive THz s-SNOM to low-temperature (LT) studies such as phase transition materials and energy dissipation of LT electrotransport devices, we have developed a LT THz optical microscope containing a chamber, providing 4.2 K environment for both CSIP and sample stage, as shown in Fig. 1(a). To efficiency extract the near-field component submerged within a large background component emitted from the focal area of the objective shown in Fig. 1(b), we introduced a confocal optics to exclude the radiation out of the focal area on the surface. In this report, we prepared a NiCr filament as a heater to heat up a Au/$SiO_2$ sample. In Fig. 1(c), the far-field signals of Au and $SiO_2$ are clearly distinguished due to the difference in emissivity. The spatial resolution of the confocal microscope is about 70 μm, better than the 110 μm obtained from the single lens optics [3]. Based on the optics improvements, we have observed the thermally excited near-field signals on the heated NiCr wire with the passive LT s-SNOM.

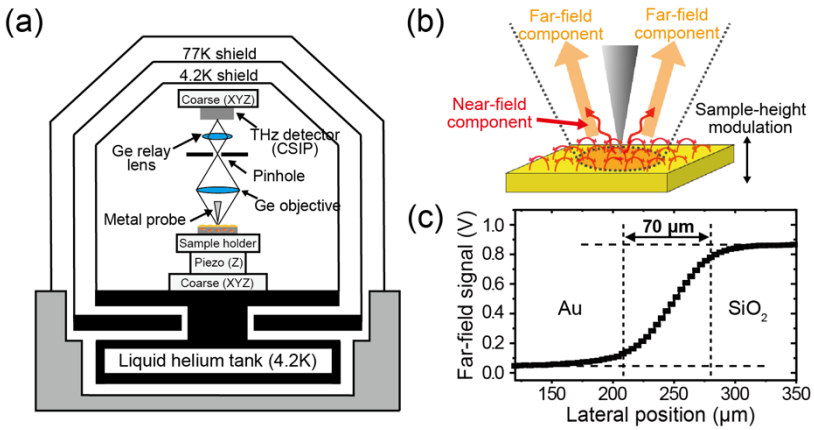


Fig. 1 (a) Schematic view of the low temperature passive THz near-field optical microscope with a confocal optics. (b) Concept of detecting evanescent waves with the LT s-SNOM. (c) Plot of THz far-field profile cross a Au/$SiO_2$ boundary. The derived spatial resolution is 70 μm.

Reference:

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[2] Q. Weng, S. Komiyama, L. Yang, Z. An, P. Chen, S.-A. Biehs, Y. Kajihara, and W. Lu, Science (80-. ). **360**, 775 (2018).

[3] 林 冠廷 他，第６６回応用物理学会春季學術講演会，“高感度検出器を利用した低温 THz 近接場顕微鏡の開発”（2019）