

## T2C

# Low Thermal Conductance Transition Edge Sensor (TES) for SPICA

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*Abstract*— Transition edge sensor (TES) is one of four detector options for SAFARI FIR Imaging Spectrometer (focal plane arrays covering a wavelength range from 30 to 210  $\mu\text{m}$ ) in Japanese SPICA telescope. Since the telescope is cooled down to 4.5 K, the instrument sensitivity is limited by the detector noise. Therefore among all the requirements, a crucial one is the sensitivity, which should reach an NEP (Noise Equivalent Power) as low as  $2 \times 10^{-19}$  W/ $\sqrt{\text{Hz}}$  at an operating temperature of 50 mK. TES detectors are used or planned in many ground-based telescopes in addition to airborne, balloon-borne, and space-borne instruments. In those ground-based applications the sensitivity is nearly two orders of magnitude lower than what SAFARI demands. The challenge of TES for SAFARI is to develop detectors which have a much higher sensitivity than what currently employed in various instruments in combination with a time constant of about 10 ms.

In collaboration with European TES team, led by a group at University of Cardiff, UK, SRON is developing TiAu TES on  $\text{Si}_3\text{N}_4$  membrane, where narrow  $\text{Si}_3\text{N}_4$  membrane legs act as low thermal links between TES and the bath. We have succeeded in fabricating and testing such devices with a critical temperature of 80 mK and obtained a very low thermal conductance, from which we expect an NEP of  $1.7 \times 10^{-19}$  W/ $\sqrt{\text{Hz}}$ , taking only an ideal case of phonon noise into account.

Some of these detectors are integrated with Ta absorbers for optical sensitivity test. IR radiation is coupled to the absorber by a circular feed horn antenna in combination with a metal back short. All hardware is in place and in principle the samples are ready for seeing first light.

We will report our latest experiments on dark and optical tests.