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Development of a TiAu TES microcalorimeter array as a backup sensor for the Athena/X-IFU instrument

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Athena is a future X-ray observatory led by ESA, to be launched in the early 2030s. The X-ray Integral Field Unit (X-IFU) instrument on-board Athena provides spatially-resolved high resolution spectroscopy of 2.5 eV with a large array of Transition Edge Sensor (TES) microcalorimeters. The main sensor is a MoAu bi-layer TES array provided by NASA-Goddard. Pixels are read out with a frequency-division multiplexing (FDM) readout system developed by SRON, using VTT SQUIDs. Extensive research collaborations between NASA-Goddard and SRON on TES design optimizations under FDM readout have resulted in new TES design rules such as: low resistivity, moderately high ohmic resistance by changing the TES aspect ratio and no metal strips on the bi-layer.
We have been developing a TiAu bi-layer based TES array as a backup option for the Athena/X-IFU. We have improved our detector fabrication procedure along the design principles. The bi-layer thickness is 35 nm Ti/200 nm Au and has ohmic resistances that vary from 50 to 150 mOhm depending on the aspect ratios. An X-ray absorber is made of 2.4 um thick Au that is thermally coupled to the TES via small stems attached to the sides of the TES. We observed Tc of 110 mK and as a preliminary result, 2.4-2.8 eV energy resolutions have been achieved with some TES pixels under the AC bias (to be reported by E. Taralli et al at this conference), showing that our TiAu TES array has a potential to be a real backup sensor for the X-IFU. In this paper, we will present our successful fabrication results and discuss on possibilities of further improvements.

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Less than 5 years of experience since completion of Ph.D

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