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The superconducting microcalorimeters array for the focal plane of the X-IFU instrument on board of the X-ray observatory Athena

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The Advanced Telescope for High-ENergy Astrophysics (Athena) has been selected by ESA as its second Large-class mission. The future European X-ray observatory will study the hot and energetic Universe with its launch foreseen in 2028.
Microcalorimeters based on superconducting Transition-edge sensor (TES) are the chosen technology for the detectors array of the X-ray Integral Field Unit (X-IFU) on board of Athena. The X-IFU is a 2-D imaging integral-field spectrometer operating in the soft X-ray band (0. 3– 12 keV). The detector consists of an array of 3840 TESs coupled to X-ray absorbers and read out in the MHz bandwidth using Frequency Domain Multiplexing (FDM) based on Superconducting QUantum Interference Devices (SQUIDs). The proposed design calls for devices with an high filling-factor, high quantum efficiency, relatively high count-rate capability and an energy resolution of 2.5 eV at 5.9keV.
The paper will review the basic principle and the physics of the TES-based microcalorimeters and present the state-of-the art of the FDM read-out.

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