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TES microcalorimeters for PTOLEMY

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The PTOLEMY project [1] is devoted to directly detect the Cosmic Neutrino Background (CNB). A key element of the project is the ability to detect few eV electrons with an energy resolution lower than 0.05 eV. Microcalorimeters based on transition-edge sensors (TES) are among the best candidates since they already reach 0.11 eV of energy resolution for telecomm photons [2]. To further increase the energy resolution it is necessary to reduce the transition temperature while maintaining a suitable saturation energy. This could be achieved by proximity effect of a normal-superconducting bilayer. To this aim TiAu very thin films are under development to demonstrate the feasibility to reach 0.05 eV energy resolution for light pulses of few eV. Thanks to the high electron stopping power of metals, the penetration depth of incident electrons is limited to few nanometers and, with respect to visible light, we expect a high detection efficiency, while similar dark counts and energy resolution. This point deserves to be investigated and a test with a cold e-gun will be planned. For the application of the microcalorimeter to the PTOLEMY experiment the use of TES arrays will be required and this implies a read-out based on SQUID - multiplexing.

[1] E. Baracchini et al., PTOLEMY: A Proposal for Thermal Relic Detection of Massive Neutrinos and Directional Detection of MeV Dark Matter, arXiv:1808.01892v1 [physics.ins-det]
[2] L. Lolli, E. Taralli, C. Portesi, E. Monticone, and M. Rajteri, High intrinsic energy resolution photon number resolving detectors, Appl. Phys. Lett. 103, 041107 (2013)

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

N

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