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Silicon microcalorimeters for high-precision X-ray spectroscopy of highly-charged heavy ions

High-precision X-ray spectroscopy in highly-charged heavy ions provides a sensitive test of quantum electrodynamics in very strong Coulomb fields, and is, therefore, an established subject within the program of SPARC. To improve the precision of such experiments, the new detector concept of silicon microcalorimeters, which detect the temperature change of an absorber after an incoming photon has deposited its energy as heat, is now exploited.

The development of silicon microcalorimeters for hard X-rays has been pursued by GSI and the collaborating groups for more than two decades, and the successful application at the ESR storage ring has been demonstrated in the recent past. With arrays of silicon thermometers and X-ray absorbers made of high-Z material, a relative energy resolution of about 1 per mille is obtained in the energy regime of 50–100 keV.

The contribution will discuss the detection principle and achieved performance as well as the technical challenges for applications at FAIR. An overview of potential applications, i.e. Lamb shift measurements, spectroscopy of inner-shell transitions or the determination of nuclear charge radii, will be discussed.

Invited Talk (yes/no)?

no

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