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Efficient X-ray optics for spectroscopy of highly charged ions

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Spectroscopy of few electron heavy ions is a unique testbed for both atomic physics, especially the test of quantum electrodynamics in strong fields, as well as for tackling astrophysical questions. The energy resolution of such measurements is limited by the use of standard semiconductor detectors. Currently, there are two ways to improve the energy resolution under investigation: on one side the use of crystal spectrometers, and on the other side, the use of magnetic metallic microcalorimeters. These new detectors could have energy resolution close to 1 eV below 10 keV and around 10 eV in the range below 100 keV. Their drawback is a small detection area and thus small covered solid angle.
The detection efficiency of the microcalorimeters could be improved by the use of x-ray optics based on high aperture mosaic crystals, which are used to transport radiation from the source to the detector. We developed, build and tested optics based on pyrolithic graphite and lithiumfluoride that could increase photon flux on the detector by up to two orders of magnitude in the energy range between 6 and 30 keV.

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