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Axisymmetric Grazing-Incidence Focusing Optics for Small-Angle Neutron Scattering

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We propose and design novel axisymmetric focusing mirrors, known as Wolter optics, for small-angle neutron scattering instruments. Ray-tracing simulations show that using the mirrors can result in more than an order-of-magnitude increase in the neutron flux reaching detectors, while decreasing the minimum wave vector transfer. Such mirrors are made of Ni using a mature technology. They can be coated with neutron supermirror multilayers, and multiple mirrors can be nested to improve their flux-collection ability. Thus, these mirrors offer simple and flexible means of significantly improving existing and future SANS instruments. In addition, short SANS instruments might become possible, especially at compact neutron sources, when high-resolution detectors are combined with Wolter optics.

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