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Soft x-rays with orbital angular momentum for resonant scattering experiments at the SOLEIL synchrotron

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The interest of extending the use of OAM beams from the visible-EUV range to the soft x-rays has been growing steadily over the last few years. Nonetheless, the offer of user accessible beamlines and endstations at synchrotron sources remains limited, especially when one aims at independently varying in a controlled way the spin and the orbital angular momenta of the x-rays. At the SEXTANTS beamline of the SOLEIL synchrotron, we have implemented and commissioned a new setup for absorption and scattering experiments with x-ray beams carrying an orbital angular momentum (OAM). Two alternative methods are available, based on the use of either spiral zone plates or fork gratings devices, and we show how they can be used for both defining and assessing the OAM of an x-ray beam. We also demonstrate that cascading multiple devices enables integer operations on the orbital angular momentum of the resulting x-ray beam. Finally, we report the results of the first resonant scattering pilot experiments in transmission and reflection mode, intended to assess the feasibility of future users' measurements. The availability of OAM-carrying soft x-rays complements the range of experimental techniques in elastic, resonant and coherent scattering available at the SEXTANTS beamline.

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