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Generation of X-Ray Vortex Beams in a Free-Electron Laser Oscillator

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Light with orbital angular momentum (OAM) provides new insights into a wide range of physical phenomena and has engendered advanced applications in various fields. Additionally, research interest in X-ray OAM has been rapidly increasing. Here, we report a straightforward method capable of generating intense OAM beams from an X-ray free-electron laser oscillator (XFEL). This method leverages Bragg mirrors and longitudinal-transverse mode coupling to enable mode selection in a conventional XFEL configuration, thereby natively producing fully coherent hard X-ray beams carrying OAM. Simulation results indicate that fully coherent hard X-ray OAM beams can be generated without the need for optical mode converters. This simple approach can significantly advance the creation of X-ray OAM while stimulating the development of novel experimental

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