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Lensless EUV Microscopy for Materials and Biological Nanoscale Imaging

Table-top high-order harmonic generation (HHG) sources now enable nanoscale EUV imaging with high amplitude and phase accuracy, achieving performance once limited to large-scale facilities. At 26 eV, reflection-mode ptychography with structured illumination on a mW-class platform delivers sub-nanometer axial resolution and >10 Mpx/h throughput. Increasing photon energies toward 90 eV enables sub-20 nm lateral resolution and micron-scale penetration in transmission diffraction geometries, with element-specific contrast for both biological and material samples. This lensless, quantitative imaging approach opens powerful new capabilities for investigating nanostructures, soft tissues, and solid-state devices in compact lab settings. Applications include Ångström-scale surface metrology, visualization of antibiotic-induced damage in bacteria, and resolving buried interfaces in battery anodes, highlighting the technique's versatility.

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