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X-ray cross-correlation analysis of crystalline defects using femtosecond X-ray pulses

Wednesday 28 August 2024 11:00 (20 minutes)

The liquid-to-solid phase transition is a complex process that is difficult to investigate experimentally with sufficient spatial and temporal resolution. X-ray Free Electron Lasers (XFELs) offer new opportunities for probing very small length- and short times-scales and make entirely new experiments possible. We employ femtosecond x-ray diffraction from microscopic liquid jets to study crystal nucleation in supercooled liquids of the rare gases argon and krypton. Our results provide stringent limits to the validity of classical nucleation theory in atomic liquids. Additionally, we demonstrate the advanced characterization opportunities for probing the three-dimensional reciprocal space of crystalline structures by X-ray cross correlation analysis (XCCA), which allows to distinguish different forms of stacking faults and follow their metastability during the crystallization process.

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