CFEL SCIENCE

SEMINAR

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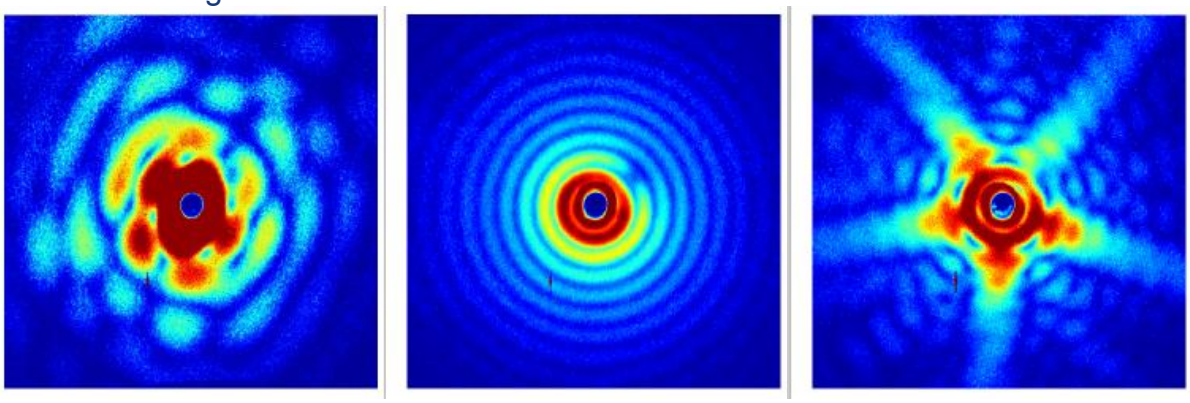
Generation and structure of extremely large clusters

Free-electron lasers like FLASH have triggered a wide range of experiments, especially for studying the geometry of nano-particles with coherent diffractive imaging technique. The scattering patterns reveal the size, structure and optical properties of single objects. In particular are-gas clusters serve as ideal prototypical models for these experiments, owing to their finite, easily scalable size and their simple electronic structure.

We studied the morphology of single clusters in dependence on their chemical composition and the development of their structure during cluster growth with XUV scattering. In the presented experiment rare-gas, water, and metal clusters were studied as target objects. While rare-gas and water clusters were produced in supersonic expansion technique, the metal clusters were generated in a magnetron sputtering source. The geometric configuration and cluster morphology depends strongly on the cluster size and the cluster constituents. As xenon and argon clusters freeze early in the growth process, they often exhibit a hailstone like shape. This is also indicative for an important role of coagulation in cluster formation. Water clusters in contrast show mostly concentric ring patterns resulting from spherical liquid droplets. Highly symmetric patterns with four-, five-, and sixfold symmetry arise from silver clusters with decahedral, icosahedral, and truncated octahedral geometries.



Depicted are scattering patterns from single clusters of xenon, water and silver. The patterns reveal hailstone-shaped, spherical, and icosahedral shaped cluster geometries.

Host: Jochen Küpper