CFEL SCIENCE

SEMINAR

16th January 2020, 10:00–11:00h

CFEL – Building 99, seminar room I and II (ground floor)

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(Microscopic) Capillary JETS: Generation, Stability, and Interaction with Extreme Energy Densities

Microscopic capillary jets have become a fundamental tool for the ultrafast imaging of molecules, particles and biological samples at XFELs. They can be considered the best sample transport candidates: their extreme density collimation (a feature of keeping a continuous liquid phase), velocity, stability, robustness and biocompatibility cannot be rivalled by any other sample transport means, including the best focused aerosol streams. In this seminar, I review the physical basics of capillary jets: their basic dynamics, their generation by various means, their stability, and their breakup. A special attention will be devoted to those generation means capable of reaching sub-micrometric scales, producing steady or transient ejections. Among the first group (steady ejections), Flow Focusing, Electrospray, and electro-Flow Focusing (including aerodynamically assisted Taylor cone-jets) will be briefly reviewed and their common physics highlighted, with a special focus on the maximum achievable velocity, minimum diameter and minimum issued liquid flow rate. In addition, the transient ejections produced by the radial collapse of capillary waves on the free liquid surfaces will also be reviewed. The appearance of soft singularities for certain parametrical combinations of geometries and liquid properties that produce extremely thin and rapid transient liquid ejections will be emphasized. Finally, the interaction of microscopic capillary jets with extremely high energy densities like those attainable by XFELs, and the basic physics involved will also be reviewed.

Host: Jochen Küpper/ CFEL Molecular and Ultrafast Science Seminar