May 28th, 2013 - 11:00

Seminar Room IV, CFEL (Bldg. 99, 01.111)

CFEL SCIENCE

Max Planck Research Department for Structural Dynamics

SEMINAR

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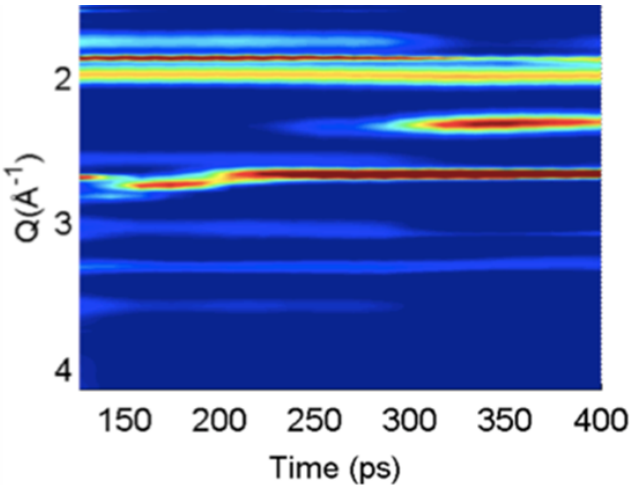
Femtosecond x-ray probes of shock-driven transformations in nanocrystals

I will describe recent experiments at the Linac Coherent Light Source utilizing laser-generated shock waves to trigger solid-solid transformations in nanocrystals. Colloidally grown nanocrystals are an ideal model system with which to study phase transformations because they are defect -free single crystalline domains. We have used x-ray scattering techniques to gain a real-time view of the mechanistic pathways and transition states associated with the wurzite to rocksalt pressure-induced transition in CdS nanorods of various shapes and sizes. First principles modeling of this transformation suggests a two- stage model with first step corresponding to compression along the c axis of the nanocrystal to form a 5-coordinate h-MgO intermediate. We observe a stress-dependent transition path: At higher peak stresses, the majority of the sample is converted directly into the rock salt phase, with no evidence of an intermediate prior to rock salt formation. At lower peak stresses, an h-MgO transition state is observed. Additionally, the observed transformation stress is significantly below the stress required under hydrostatic compression, confirming previous observations of shear catalyzed structural transformations under shock compression.



Host: Andrea Cavalleri, MPSD-CFEL