



2020 HGF – OCPC – Programme for the involvement of postdocs in bilateral collaboration projects

Title of the project:

Structure and dynamics of controlled bio-nanoparticles: Cooling, controlling, and imaging

Helmholtz Centre, division/group:

DESY, CFEL Controlled Molecule Imaging (FS-CFEL-CMI)

Project leader:

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Department/Group: (at the Helmholtz centre or Institute)

Center for Free Electron Laser Science (CFEL)
Controlled Molecule Imaging Group

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Description of the project (max. 1 page):

Within this project, we will use our newly developed sources for cold nanoparticles and bio-molecules, such as cryogenic buffer-gas cells, and develop advanced methods to strongly control nanoparticles and biological macromolecules. We have experimentally demonstrated our approach by creating a high-flux beam of artificial and biological nanoparticles. Further method development (such as a double-cell configuration, different cryogenic coolants, etc.) on improving particle beam focusing and cooling-rates is foreseen and will be part of this project.

The shock-frozen, cold samples emitted from the buffer-gas cell can be further controlled using strong inhomogeneous electric fields. This allows one to select single structural isomers, i.e., different structural arrangements such as folded vs. globular proteins, based on their distinct interactions with the field. Furthermore, in combination with strong ac electric or laser fields these systems can be aligned and oriented in space, rendering the individual molecules practically identical – even in laboratory space. The developed methods and experimental setups will be employed for novel diffractive-imaging experiments, both at x-ray free-electron laser (XFEL) facilities as well as in laboratory based setups. Furthermore, it provides the prerequisites for future time-resolved studies of ultrafast biochemical dynamics, which require well-defined starting states to controllably and reliably trigger specific dynamic processes of interest.



Description of existing or sought Chinese collaboration partner institute (max. half page):

Required qualification of the post-doc:

- PhD in experimental physics, physical chemistry, or a related field
- Experience with cryogenics and high-vacuum equipment is highly desirable
- Additional skills in particle imaging and pulsed lasers are a plus
- Language requirement: English