## Illuminating Biomolecular Complexity: X-ray Free Electron Lasers and Vibrational Spectroscopies for Protein, Aggregates, and Cellular Architectures



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## Orienting gas-phase proteins with electric fields for X-ray imaging

Sunday, June 29, 2025 9:45 AM (35 minutes)

Using X-ray diffraction for structure determination is further complicated when the irradiated particles have random and unknown orientations, because it means that the relations between the diffraction images are also unknown. Algorithms exist for recovering the relative orientations between diffraction patterns, but they do not always converge, especially not when faced with scarce or noisy data. Controlling the orientation of the particle would help overcome this problem in single particle imaging and related techniques. We once demonstrated the possibility of orienting proteins in the gas phase without destroying their structures using strong electric fields via the interaction with their electric dipole moments. More recently we have explored more aspects of dipole orientation, including if and how it actually helps the orientation recovery, and how the orientation is affected by a thin layer of water around the protein, which has been shown to have other benefits for single particle imaging. We hope that our results can serve to guide the development of new technology and experiments that utilise dipole orientation for structure determination of macromolecules. To that end, we here present our current research in dipole orientation of gas-phase proteins.

## Scholarship elegibility

no

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