

Cylindrical specimens for electron cryo-microscopy, and, an overview of CCP-EM

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Specimens for electron microscopy normally have a flat slab geometry, which restricts the range of angles available for observation. In electron tomography, this gives rise to the “missing wedge” problem, referring to the wedge-shaped region of Fourier space that cannot be observed. The same problem arises in electron crystallography. In both cases, this leads to incomplete data and highly anisotropic resolution. One solution, well known in X-ray crystallography, is to use cylindrical specimens: a cylinder can be viewed with equal quality from all angles around its longitudinal axis and therefore does not suffer from any missing information.

In this talk, I will discuss the manufacture and use of cylindrical specimens for electron cryo-microscopy. My work[1] demonstrates that it is possible to make frozen-hydrated cylinders with sub-micron diameters, keep them stable under high-vacuum conditions by contact cooling, and observe them in the TEM from a very wide range of tilt angles, thereby filling the missing wedge in Fourier space. As well as their original purpose in electron tomography, I will discuss potential applications in electron crystallography. I will also give a brief overview of my current work at CCP-EM, the Collaborative Computational Project for Electron cryo-Microscopy.

References

1. Palmer, C. M. & Löwe, J. (2014). A cylindrical specimen holder for electron cryo-tomography. *Ultramicroscopy* 137:2029. doi:10.1016/j.ultramic.2013.10.016