

Workshop on Energy Recovery Linac Source  
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## **Vertical undulations - a more convenient source for diffraction experiments**

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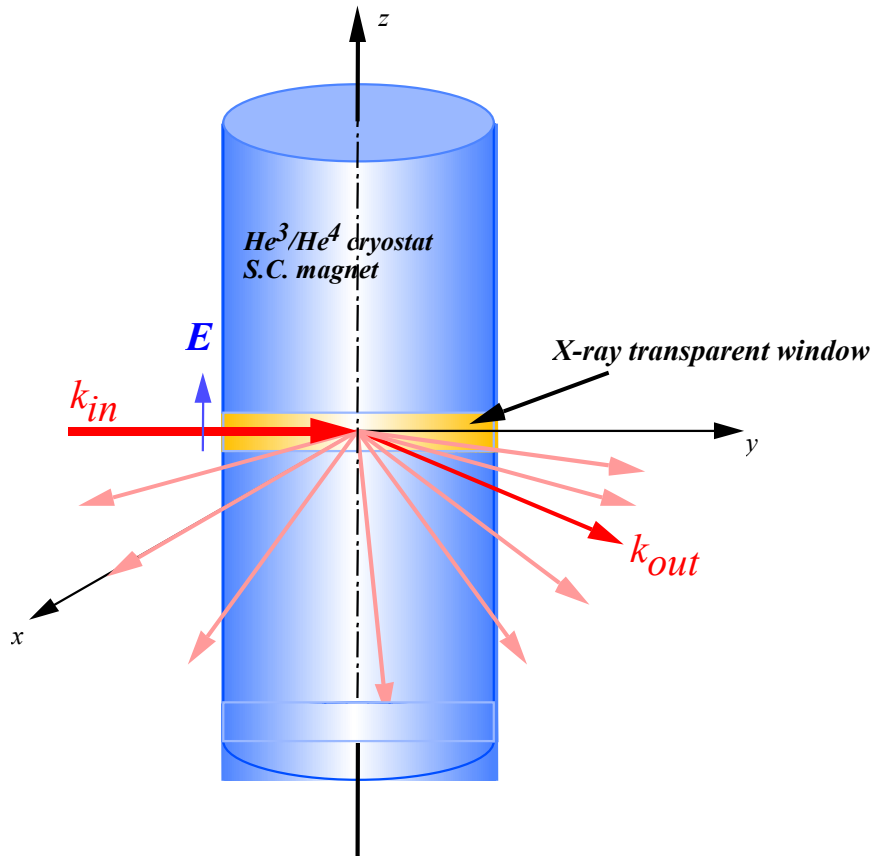
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### **Abstract**

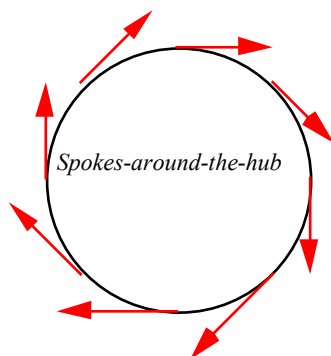
In many condensed matter diffraction studies one is interested in studying the structure of the sample at extreme conditions such as very low temperatures, high magnetic fields etc. The auxiliary equipment needed around the sample to provide that environment is often bulky and heavy, and may require liquid nitrogen and Helium for cooling in some sort of vertical container cryostat. Examples of such set ups are plentiful at neutron scattering facilities, and in almost all cases the diffraction plane is horizontal for neutron scattering studies.

A horizontal scattering plane is rarely used at X-ray synchrotron storage ring facilities because the polarization of the radiation from bending magnets and wigglers is horizontal - the Thomson scattering from the electrons in the sample would therefore depend on the scattering angle and in fact completely vanish at 90 degrees scattering angle. Also undulator sources are usually designed for horizontal polarization because in a storage ring the emittance is so much better in the vertical plane. However, in the planned ERL source the emittance in the horizontal plane may be very good, and one could just as well design the undulator so that the undulations take place in the vertical plane rather than in the horizontal plane. The advantage would be that a horizontal diffraction plane from the sample could be used just as is done in neutron diffraction studies, and the techniques of extreme sample environment common in neutron diffraction studies can readily be carried over to X-ray studies.

Another advantage of vertical polarization may be the larger degree of freedom one obtains for the general lay-out of beamlines. For spectroscopy it is convenient to use a double crystal monochromator, so that the monochromatic beam is parallel to synchrotron beam at all energies. This is the common geometry around synchrotron storage rings and leads to the well-known "spokes-around-hub" beam line lay-out. The double monochromator would work just as well with vertical polarization, but now one can in addition add a single crystal monochromator at a fixed, arbitrary horizontal take-off angle. The single crystal monochromator can be transparent to X-ray energies needed further down stream in the undulator beam if one for example use diamond crystals.



### Storage ring beam line geometry



### ERL beam line geometry

*Fixed energy (a)*

