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IRIS - A pulsed source quasielastic and inelastic spectrometer

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Abstract

The backscattering technique for high resolution quasielastic and inelastic spectroscopy, used in the investigation of the dynamics of condensed matter, has been extended by its application to pulsed neutron sources. Whilst the wavelength band for reactor based spectrometers is obtained by using complicated instrumental techniques (e.g. Doppler shifting or temperature scanning), the pulsed source variant of such a spectrometer is provided with the wavelength band relatively simply by utilising the pulsed nature of the source and the time of flight dispersion of the neutrons over an incident flight path. Not only is the wavelength band selected by this technique wider than that from other methods but, by simply rephasing the waveband selection chopper to different energies, truly high resolution inelastic spectroscopy can be performed.

The above method has been used in the design of the IRIS spectrometer which is being commissioned on the Spallation Neutron Source at RAL. The incident beam resolution is defined by the dispersion of the narrowly pulsed beam over a ~ 30 metre incident flight path and the scattered beam is analysed by backscattering techniques. The spectrometer will use three different analyser systems which are being installed in phases. The first phase, which is now operational, uses a double polycrystalline beryllium filter and provides elastic resolutions of ~ 50 μeV over an energy transfer range of ~ 20 meV and at Q's up to 3 $Å^{-1}$. The second phase, to be installed in 1986, uses pyrolytic graphite analysers in backscattering and provides an elastic resolution of ~ 12 μeV over the same energy transfer range and at Q's up to 2 $Å^{-1}$. The third phase will use silicon analysers and will provide elastic resolutions of ~ 1 μeV over the same ranges of $\hbar\omega$ and Q.

IRIS will be fully operational by the end of 1986 and will provide an extension of the facilities available for the study of diffusive molecular motions. It will also greatly increase the energy transfer range available for microvolt inelastic scattering spectroscopy.

References

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