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The Science Motivating the UK's Fourth Generation Light Source Project

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The UK is committed to developing a proposal for a long wavelength (THz - soft X-ray) 4th generation light source that will provide short-pulse synchronised beams to be used in combination. Some of the science motivating the development of this facility is described. The facility will probe ultra-fast dynamics in a wide range of fields. 'Pump-probe' experiments will allow the study of chemical reactions and short-lived intermediates on the timescale of bond formation, even for very dilute species. Circularly polarised light sources in a variety of frequency regimes will be used for example to manipulate and monitor carrier charge and spin transport in device structures. The high intensity of the free electron laser (FEL) radiation will allow high resolution in imaging and the opportunity to probe nonlinear regimes and new states of matter. Lower intensity, high repetition rate spontaneous radiation will provide ideal sources for ultra-high energy resolution spectroscopy, especially in the solid state. Around £22 M funding has been obtained for the first stages of the project (construction of a prototype energy recovery linac (ERL) source, science demonstrations and design study work, currently underway at STFC Daresbury Laboratory).