ABSTRACT

XAS and XMCD at Ultra-Low Temperatures

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Ultra-low temperatures (ULT: below 1 Kelvin) are essential for exploring novel states of matter and magnetic phenomena. At the DEIMOS beamline of the SOLEIL synchrotron, a newly developed ULT refrigerator tailored for soft X-ray Magnetic Circular Dichroism (XMCD) experiments achieves measurements as low as 220 mK. Investigations on ErPd alloys and Fe4 molecules have highlighted the system's exceptional performance, including its ability to reach ultra-low temperatures under X-ray illumination, maintain precise temperature control over four orders of magnitude, execute rapid cooling and heating cycles, and minimize eddy current power, enabling fast magnetic field scans during XMCD experiments.
This presentation will detail the modifications made to the 7 Tesla cryo-magnet to optimize thermal shielding while preserving compatibility with X-ray-based experiments. Additionally, it will discuss the thermometric methods developed for accurate temperature calibration at the sample position. To illustrate the scientific potential of this technique, I will present results on Fe4 films deposited on a superconductor, showcasing the magnetic behaviors observed across the superconducting transition window.