



22nd International Conference on
Diffusion in Solids and Liquids
22 TO 26 JUNE 2026 | RHODES, GREECE

ABSTRACT:

Play it Again: Recovering High-Fidelity Audio from Degraded Tapes using
X-Ray Magnetic Dichroism

It is estimated that approximately 50 million hours of unique audio heritage are recorded on magnetic tape, stored in archives worldwide in various states of decay and in urgent need of digitization. Concurrently, the lifespan of these archived tapes is reaching its limit due to chemical degradation, leading to a “race to digitize.” If no action is taken, this could result in the permanent loss of cultural heritage and artistic works, with a monetary value estimated in the hundreds of millions of dollars. We demonstrate that the non-destructive recovery of analog waveforms from music recordings can be achieved using Resonant Inelastic X-ray Scattering Magnetic Circular Dichroism. This project, initiated in 2022, comprises an extensive scientific collaboration among European synchrotrons and research centers. To date, we have succeeded in optimizing and accelerating the experimental setup and data acquisition, culminating in the successful recovery of several seconds of Beethoven’s Fifth Symphony from recordings obtained at the GALAXIES beamline at Synchrotron SOLEIL.