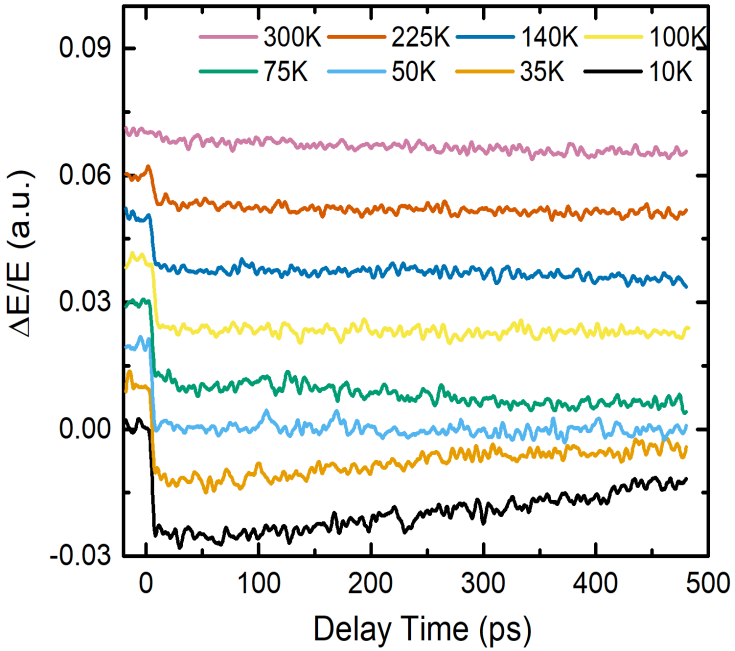
Electrodynamics of Photo-Carriers in Multiferroic $Eu_{0.75}Y_{0.25}MnO_3$



The transient change in terahertz transmission as a function of temperature (T) due to the photoinduced carriers. The fast decrease is due to thermalization of the spin and lattice systems; the slow recovery is due to electron-hole recombination which is >10 nanoseconds at high T and occurs on a sub-nanosecond timescale in the magnetic phase (low T).

Scientific Achievement

Ultrafast carrier dynamics in the multiferroic $Eu_{0.75}Y_{0.25}MnO_3$ revealed two relaxation times due to spin-lattice relaxation and magnetic order-related recovery due to electron-hole recombination, as well as the suppression of electromagnons.

Significance and Impact

The observed magnetic processes underpin the control of magnetism and photoinduced phase transitions in multiferroics.

Research Details

An optical-pump terahertz probe study excited d-d transitions of the Mn^{3+} ion and the temporal evolution of the pump-induced transient conductivity was measured on a picosecond timescale with the the time-delayed terahertz pulse.

Work was performed, in part, at the Center for Integrated Nanotechnologies

Huang, Y.; Aguilar, R. V.; Trugman, S. A.; Cheong, S.-W.; Long, Y.; Lee, M.-C.; Zhu, J.-X.; Rosa, P. F. S.; Prasankumar, R. P.; Yarotski, D. A.; Azad, A.; Sirica, N. S.; Taylor, A. J. Electrodynamics of Photo-Carriers in Multiferroic EU0.75Y0.25Mno3. *Nanophotonics* 2025.