Time-reversal symmetry breaking by a \((d + id)\) density-wave state in underdoped cuprate superconductors

VICTOR YAKOVENKO, SUMANTA TEWARI, CHUANWEI ZHANG, SANKAR DAS SARMA, Department of Physics, University of Maryland — It was proposed that the \(idx^2−y^2\) density-wave state (DDW) may be responsible for the pseudogap behavior in the underdoped cuprates. Here we show that the admixture of a small \(d_{xy}\) component to the order parameter of the DDW state breaks macroscopic time reversal symmetry, leading to a non-zero polar Kerr effect. The \(d_{xy}\) component breaks the symmetry between the counter-propagating orbital currents of the DDW state, which is ultimately responsible for the non-zero Kerr signal. From the results of the recent experiments by Xia et al., arXiv:0711.2494, we deduce that the amplitude of the \(d_{xy}\) admixture is quite small compared to the ordered DDW component.