Cooling quasiparticles in A3C60 fullerides by excitonic mid-infrared absorption

Michele Fabrizio, SISSA, Trieste, Italy

A fresh inroad in the ever-surprising physics of alkali-doped fullerides has been the behavior e to a transient superconducting state extending up to temperatures ten time higher than the equilibrium Tc ~ 20K have been discovered in K3C60 after ultra-short pulsed IR irradiation. Motivated by the observation that the phenomenon is observed in a broad pumping frequency range that coincides with the mid-infrared electronic absorption peak still of unclear origin, we advance here a radically new mechanism [1]. First, we argue that this broad absorption peak represents a "super-exciton" involving the promotion of one electron from the t1u half-filled state to a higher-energy empty t1g state, dramatically lowered in energy by the large dipole-dipole interaction acting in conjunction with the Jahn-Teller. Both long-lived and entropy-rich because they are triplets, the IR-induced excitons act as a sort of cooling mechanism by absorbing thermally excited quasiparticle-quasihole spin-triplet excitations, which permits transient superconductive signals to persist up to much larger temperatures.

[1] A. Nava, C. Giannetti, A. Georges, E. Tosatti, M. Fabrizio. Accepted for publication on Nature Physics (2017).