

Optical Processing of Information in Doped Semiconductors

Carlo Piermarocchi

MICHIGAN STATE
UNIVERSITY

We study the **light-induced interaction** between spins localized by impurities in a semiconductor host. Fig. a: the laser creates electron-hole pairs in the semiconductor and mediates a spin-spin coupling between electrons in donors. Fig. b: the coupling depends on the frequency of the laser δ and the distance R . Ferromagnetic (FM) and Anti-Ferromagnetic (AF) coupling are possible. This mechanism can be used to control **qubits** stored in the impurities and process optically **quantum information**; it also opens to new **controllable materials** whose magnetic properties can be controlled by changing the spin-spin coupling with lasers.

Two graduate students supported by NSF are working on optically controlled semiconductors: G. Quinteiro (inorganic materials) and M. Katkov (organic materials). **One undergraduate student** (S. Cooper from Carleton College), joined the group in the summer 2004 and developed numerical codes for simulations. **One postdoc** (Y. Pershin), supported by MSU, has recently joined the group to work on the project.

Basic applications of **optics in quantum information technology** have been included in the list of topics of the **undergraduate class** I am currently teaching (Optics I).

