Laser spectroscopy of a doubly charged quantum dot molecule
DANNY KIM, ALEX GREILICH, ALLAN BRACKER, MARK BASHKANSKY,
DAN GAMMON, Naval Research Laboratory, NAVAL RESEARCH LABORA-
TORY TEAM — The spectra of a self-assembled quantum dot molecule (QDM)
precharged with two carriers is presented. The QDM is deterministically charged
with two electrons, where one resides in each dot. The finite tunnel coupling between
these two electrons results in triplet states and a well separated singlet state. These
four ground states can be optically excited to four molecular trion states. The fan
diagram of this exciton system is investigated in Faraday and Voigt fields. At certain
fields an anticrossing between the singlet and triplet ground states is observable, the
magnitude of which gives a direct measure of the asymmetric exchange interaction
in this system. The complimentary two-hole molecule is also studied (with a hole on
each dot), where optical spin pumping is observed. These experiments are impor-
tant in realizing an optically operated singlet-triplet qubit and realizing two-qubit
entanglement in self-assembled quantum dots.

Danny Kim
Naval Research Laboratory

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