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Laser spectroscopy of a doubly charged quantum dot molecule DANNY KIM, ALEX GREILICH, ALLAN BRACKER, MARK BASHKANSKY, DAN GAMMON, Naval Research Laboratory, NAVAL RESEARCH LABORATORY 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 important in realizing an optically operated singlet-triplet qubit and realizing two-qubit entanglement in self-assembled quantum dots.

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