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Transition metal doped semiconductor quantum dots: Optical and magnetic properties YURI DAHNOVSKY, VITALY PROSHCHENKO, ARTEM PIMACHEV, Department of Physics Astronomy, University of Wyoming — We study optical and magnetic properties of CdSe and Cd-Mn-Se quantum dots (QD). We find that there are two luminescence lines, one is fast and another is slow (˜1ms). With the increase of a QD diameter the slow luminescence disappears at some critical QD size, thus only one line (fast) remains. Using the SAC SI computational method we find that D = 3.2 nm and D = 2.7 nm if the Mn impurity is located inside a QD or on a QD surface, respectively. For two or four Mn atoms in the quantum dot, now absorption takes place because the transition is spin-allowed. The DFT calculations of the magnetic state reveal that it is an antiferromagnet. We also study other quantum dots such as Cd-Mn-Se, Zn-Mn-S, and Zn-Mn-Se, doped and undoped. We find the slow luminescence energies for low concentrations of Mn impurities for each QD type. The calculations indicate that two luminescence lines, fast and slow, should always take place. However for Pb-Mn-S quantum dots there are now Mn levels inside a HOMO-LUMO gap, i.e., the Mn-levels are located in a PbS conduction band. The presence of Mn dopants increases the band gap and also removes the exciton peak. This effect is different to the other quantum dots.

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