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Multiple exciton dynamics in semiconductor quantum dots

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More than one exciton can be created in a quantum dot when we use intense light from the lasers to excite the excitons. Multiple excitons in a quantum dot undergo Auger recombination within few tens of picoseconds and reduce the exciton population to a long lived single exciton in a quantum dot. The dynamics of Auger recombination is often used to quantify the population of multiple excitons in an ensemble of quantum dots. Multiple excitons can also be created by impact ionization when a high energy photon is used to excite the quantum dots. This phenomenon is known as multiple exciton gener- ation (MEG). The yield of MEG in quantum dots have been quantified by following the dynamics of Auger recombination after the process of MEG has completed. The direct observation of the process in a time-resolved spec- troscopy measurement has been elusive. Application of the recently developed technique of photocurrent detected two-dimensional spectroscopy shows that the MEG occurs in sub-picosecond time scale in PbS quantum dots. As the photocurrent generated in the quantum dot based photocell is observed in the measurements, the results also show that the multiple excitons in a quantum dot can be extracted to generated photocurrent, implying that MEG could be used to enhance the efficiency of solar cells.

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Correlation between electron mobility and static dielectric permittivity of n-InSb

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Numerical calculations of the static dielectric permittivity- dependent electron mobility due to different types of elastic scattering mechanisms for n-type InSb were carried out. The calculated static dielectric permittivity increases by increasing of donor concentration. The temperature dependence of the electron mobility from 10 K up to 300 K has been demonstrated. Generally, the electron mobility shows peak behavior in this range of temperature. The direct correlation between the electron mobility and the static dielectric permittivity at 300 K was investigated. The dependence of the electron mobility on donor concentration was discussed when the static dielectric permittivity is assumed to be varying and when it is assumed to be a constant. The difference in behavior was noticed particularly at high donor concentrations.

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