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Τίτλος

«High temperature spin polarization in trapped polariton condensates»

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ABSTRACT

Exciton-polaritons are quasiparticles that emerge from strong light-matter interaction. Polaritons, being light-matter hybrids have strong bosonic characteristics while exhibiting strong non-linearities. Owing to their small effective mass, they are an excellent candidate for studying condensed matter phenomena, as they easily form condensate similar to atomic Bose-Einstein condensates. By taking advantage of the potential landscape generated by the exciton-exciton interactions, we create optical traps through the manipulation of the pump beam geometry. Trapped polariton condensates are delocalized form the excitonic pumps thus showing greater stability and lower blueshift. Moreover, they are less affected by the delcoherence and spin noise of the excitonic pumps. By controlling the ellipticity regarding the polarization of the excitation beam, we tune the spin polarization of trapped polariton condensates.

In this thesis, two experimental setups were developed in order to explore the temperature dependence of the degree of polarization in optically trapped polariton condensates in pursuit of real world applications that require room temperature. In the first experiment, trapped polariton condensate emission is analyzed by spatially separating the two circularly polarized components projected simultaneously onto a CCD detector coupled to spectrometer. Temperature dependence of time-averaged spin polarization of trapped condensates is also obtained. In the second experiment, temperature resolved spin dynamics of polariton condensate emission and spin flips are analyzed using two separate photomultiplier tubes. At low temperatures, we observe spin polarization > 85%, while at 90K it does not drop below 75%. Finally, we study stochastic spin flips of polariton condensates when excited by linearly polarized light and the effect of temperature on the spin flip rate. We are able to measure spin flip at the record temperature of 90K.