

Condensation of Excitons and Exciton-Polaritons in Semiconductor Nanostructures

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Excitons, the solid state analogue of the hydrogen atom or of positronium, have played a significant role in elucidating the optical properties of solids. The current interest in exciton physics is due to the possibility of creating novel nanoscale semiconductor structures of reduced dimensionality. In these systems, quantum size effects dramatically reshape the many-body interactions; therefore, these systems are ideal test beds for understanding quantum collective phenomena such as Bose-Einstein condensation (BEC). In particular, due to the light effective mass, excitons are expected to undergo BEC at a temperature six order of magnitude higher than that of atomic BEC. In planar semiconductor microcavities, the strong coupling between the microcavity photons and quantum well excitons further leads to the formation of quasiparticles known as exciton-polaritons. I will review key developments on the exciton and exciton-polariton condensations in semiconductor nanostructures. Specifically for exciton-polariton systems, I will report the following experimental observation of collective effects: (1) first and second order coherence, (2) Bogoliubov-like excitation spectra, (3) polarization properties of the condensates, and (4) coherent zero-state and π -state in an exciton-polaritonic lattice.

References:

- "Coherent zero-state and π -state in an exciton-polariton condensate array", Nature 450, 529 (2007)."
- "Observation of Bogoliubov excitations in exciton-polariton condensates", Nature Physics 4, 700 (Sep 2008).

Host: Juan Peralta

Cookies and coffee @ 3:30pm in Dow 201.