HL 20: Symposium Bose-Einstein Kondensation in Halbleitern

Time: Tuesday 10:45–12:45 Location: H15

Invited Talk HL 20.1 Tue 10:45 H15

Polariton Condensation in CdTe Microcavities: interaction and coherence — J. Kasprzak[1], M. Richard[2], S. Kundermann[2], A. Baas[2], P. Jeambrun[2], J. Keeling[3], F. M. Marchetti[4], M. H. Szymanska[5], R. André[1], J. L. Staehli[2], P. B. Littlewood[4], B. Deveaud[2], and •Daniel Le Si Dang[1] — [1]Laboratoire de Spectrométrie Physique, CNRS-Université J. Fourier-Grenoble, France — [2]Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland — [3]M.I.T., Cambridge (Ma.), USA — [4]Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom — [5]Clarendon Laboratory, University of Oxford, Oxford, United Kingdom

Polaritons in semiconductor microcavities are quasi-particles which result from the strong coupling between confined photons and electronic excitations. These bosons are 10^9 times lighter than rubidium atoms, thus permitting BEC to occur at low density and high temperature. In this talk we present evidence for polariton condensation at around 20 K in a CdTe microcavity [Bose-Einstein condensation of exciton polaritons, Kasprzak et al., Nature 443, 409 (2006)]. We show also how the spontaneous coherence of the polariton condensate differs from the ideal case of non interacting bosons. We gratefully acknowledge support from the EU Network HPRN-CT-2002-00298 "Photon-mediated phenomena in semiconductor nanostructures".

Invited Talk HL 20.2 Tue 11:15 H15

On the way to an excitonic Bose-Einstein condensate: New experiments in Cuprous Oxide. — •Heinrich Stolz[1] and Dietmar Fröhlich[2] — [1]Institut für Physik, Universität Rostock, Universitätsplatz 3, 18055 Rostock — [2]Institut für Physik, Universität Dortmund, Otto-Hahn-Straße 4, 44227 Dortmund

The lowest exciton transitions in Cu_2O are considered to be an ideal system to observe Bose-Einstein condensation (BEC). Despite the large experimental efforts, (for a review see Ref. [1]), a clear evidence for an excitonic BEC was not given up to now. In this contribution we present temperature and excitation power dependent absorption measurements of the paraexciton, which is the lowest exciton state of the yellow series, via the polariton effect using a tunable single frequency laser. At 10 Tesla we get in high quality samples an absorption coefficient of about 80 cm-1 and a line width of 80 neV at T=1.2K and μW laser power. The absorption line shows a blue-shift and a broadening with increasing intensity. Both effects can be explained quantitatively by taking acoustic phonon scattering and a density dependent exciton-exciton interaction into account. Under these excitation conditions we observe in phonon sidebands of the paraexciton emission a sharp peak at the low energy side. The possibility that it reflects resonant Raman scattering or a transition from k = 0 excitons and thus a BEC is discussed, based on its characteristic density and temperature dependence. [1] D. W. Snoke, Science **298**, 1368 (2002).

Invited Talk HL 20.3 Tue 11:45 H15

Challenges on the way towards Bose-Einstein condensation of excitons — •Roland Zimmermann — Institut für Physik der Humboldt-Universität zu Berlin, Newtonstr. 15, 12489 Berlin

Starting with the ideal Bose gas in a trap, necessary prerequisites for reaching condensation in exciton systems are discussed, and actual experimental attempts are critically reviewed. More details are given on high-density excitons in coupled quantum wells with a lateral trap. Taking into account the strong dipole-dipole repulsion between these spatially indirect excitons, we have implemented a dynamical T matrix approach and present numerical results. The spectral lineshape of the emitted luminescence as well as its angular characteristics provide clear signatures for the approach to condensation which, however, has not been reached yet.

Invited Talk HL 20.4 Tue 12:15 H15

Signatures of excitonic condensates in quantum Hall bilayers — •Lars Tiemann[1], Rodney Wiersma[1], Sjoerd Lok[1], Werner Dietsche[1], Klaus v. Klitzing[1], and Koji Muraki[2] — [1]Max-Planck Institute für Festkörperforschung, Heisenbergstr. 1, 70569 Stuttgart — [2]NTT Basic Research Laboratories, Atsugi, Japan

Experiments on two closely spaced 2D electron double layers under strong perpendicular magnetic fields, where each layer's filling factor is near 1/2, show signatures of a Bose-Einstein condensate of interlayer excitons. In drag experiments, where a current is flowing in only one layer, a quantized Hall voltage of h/e^2 over both layers is observed while the longitudinal voltages vanish. This behavior is regarded as a consequence of interlayer lectron-hole pairs (=excitons) residing in the same quantum mechanical state, analogue to atomic Bose-Einstein condensates. Complementary experiments with counter flowing currents in both layers imply a superfluid-like transport mode of these interlayer excitons. While all previous work focused on Hall bars, our recent experiments performed on a ring structure reveal that the radial (or σ_{xx}) conductance in the current-carrying layer only slowly diminishes with decreasing temperature and a given coupling strength. In contrast to Hall bars, voltages of equal value build up over both layers even in the weak coupling limit and at temperatures exceeding 0.3 K. In the limit of T $\longrightarrow$ 0 K and sufficiently strong coupling between the two layers, the conductance vanishes altogether and the voltages over both layers equal the externally applied excitation voltage.