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## NOVEL DIRECTIONS IN STUDIES OF ELECTRON-HOLE LIQUID IN SEMICONDUCTORS: WIDE GAP AND 2D MATERIALS

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The low-temperature electron-hole plasma may undergo phase transition to the liquid state: the electron-hole liquid (EHL). The transition is allowed in dense plasma below critical temperature  $T_C$  and it exists only in the thermodynamic limit, i.e. when the lifetime of the electron-hole system is long enough to reach the thermal equilibrium. For that reason, the macroscopic and relatively long-lived EHL is exclusively observed in the indirect semiconductors. This liquid phase is the two component degenerate Fermi liquid. EHL has a form of spatially separated “droplets” within a cloud of EHP or excitons. In close analogy with conventional liquids EHL has constant density at given temperature – it is related to the quasiparticle distance for which their energy is minimized. Decay of EHL droplets via electron-hole recombination is faster than decay of free excitons – fortunately, this decay includes radiative recombination processes giving rise to photoluminescence (PL) which is the most important messenger bringing information on EHL. The investigation of the intriguing new “matter” was conducted mostly in 1970ies in Si and Ge. EHL was later observed also in low-dimensional semiconductor structures. Here we present recent results on wide-gap semiconductors (especially 4H-SiC) and the graphene-like materials like MoS<sub>2</sub>.

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