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Drag effects in a system of electrons and microcavity polaritons

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— The theory of the drag effects in the system of spatially separated electrons and excitons in coupled quantum wells (QWs) embedded in an optical microcavity is developed. It is shown that for systems of spatially separated interacting quasiparticles is the possibility of controlling the motion of the quasiparticles of one subsystem by altering the parameters of state of the quasiparticles in the other subsystem, for example, controlling the flow of polaritons or exciton using a current of electrons. At low temperatures, the electron current dragged by the polariton flow is strongly suppressed and hence, the absence of the electron current indicates the superfluidity of polaritons. However, the polariton flow can be dragged by the electrons, and, therefore, there is a transport of photons along the microcavity, which decreases with rise of the superfluid component and can be observed through the change in angular distribution of photons discussed above. At high temperatures, from one hand, the existence of the electric current in the electron QW indicates the exciton flow in the other QW, and from the other hand, the electron current in one QW induces the exciton flow in the other QW via the drag of excitons by the electrons. The drag coefficients for the polariton-electron systems are calculated and analyzed.

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