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Resonant spin-Hall effect in Rashba and Dresselhaus systems BAO YUNJUAN, SHEN SHUNQING, The University of Hong Kong — In this letter, the resonant spin-Hall effect is researched in 2-dimensional electron gases with Rashba-type and Dressellhaus-type spin-orbit coupling in the presence of a strong perpendicular magnetic field and a weak in-plane electric field. The calculation is focused on the Rashba system using the Kubo-linear-response theory. Spin-Hall conductance is found to diverge at a unique magnetic field for weak electric fields and low temperatures. The divergence comes from the interference of the two crossing Landau levels near Fermi surfaces induced by the competition between Zeeman splitting and Rashba coupling. At the resonant point, the non-linear-response theory is used to deal with the temperature and electric field dependence. At low temperature, the resonant spin-Hall current increases with the electric field and approaches to a constant and accordingly the conductance diverges as $1/E$. For finite electric fields, the height of the peak is shown to diverge as $1/T$ and the weight as $\ln T$. In contrary, the Dresselhaus coupling enhances the Zeeman splitting and thus suppresses the resonance. The situation of both couplings coexisting is discussed based on the perturbation method. The spin-Hall conductance is demonstrated for different ratios of the Rashba coupling and Dresselhaus coupling. It is displayed that the peak retains when the Rashba coupling dominates and the peak height decreases with the ratio minishing.

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