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Abstract:

We report observation of intrinsic inverse spin Hall effect in un-doped GaAs multiple quantum wells with a sample temperature of 10 K. A transient ballistic pure spin current is injected by a pair of laser pulses through quantum interference. By time-resolving the dynamics of the pure spin current, the momentum relaxation time is deduced, which sets the lower limit of the scattering time between electrons and holes. The transverse charge current generated by the pure spin current via the inverse spin Hall effect is simultaneously resolved. We find that the charge current is generated well before the first electron-hole scattering event. Generation of the transverse current in the scattering-free ballistic transport regime provides unambiguous evidence for the intrinsic inverse spin Hall effect.