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# Shot Noise Induced by Nonequilibrium Spin Accumulation

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## Abstract

In 1918, Schottky showed that the electric flow in a vacuum tube fluctuates and the resulting current noise spectral density is proportional to the unit of charge and to the mean current. This is the shot noise, the direct result of the discreteness of the electron charge. As an electron possesses spin as well as charge, one may ask how the discreteness of electron spin affects the current fluctuation. Although such "spin shot noise" has been discussed theoretically in various contexts [1-6], it has never been proven experimentally. Here we demonstrate the detection of shot noise induced by nonequilibrium spin accumulation in a lateral all-semiconductor spin valve device. This proves the relevance of the above concept of spin shot noise [7]. By using the Landauer-Büttiker formalism, we successfully extracted charge and spin currents and charge and spin noise and found that the spin degree of freedom is preserved in electron tunneling. Recently, we discuss the dynamics of the spin current in the high-frequency quantum regime [8]. Given the importance of shot noise in various fields, especially in device technology and mesoscopic physics, spin shot noise could serve as a unique probe to explore nonequilibrium electron transport.

I appreciate my collaborators of this work, T. Arakawa, J. Shiogai, M. Kohda, J. Nitta, M. Ciorga, M. Utz, D. Schuh, D. Bougeard, D. Weiss and T. Ono.

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