**The paper "Possibility of Orienting Electron Spins with Current "( Dyakonov M.I., Perel' V.I. 1971) .**

The work [1] appeared in the course of theoretical studies in a completely new domain (at the time): the creation and registration of non-equilibrium spin polarization of carriers in semiconductors. This field was opened in 1968 by the pioneering work of Lampel [2] who introduced to solid state physics the ideas and methods of optical orientation and alignment of atomic angular momenta in gases developed by Kastler [3] and his school. Both for atoms and electrons in semiconductors, absorption of circularly polarized light results in orientation of electron spins. Because of this, the luminescence (or recombination radiation) also become circular polarized and this can be easily registered. During the time interval between the creation of spin-polarized electrons and their recombination, the spin might be subject to precession in magnetic field, besides spin relaxation occurs, as well as interesting processes of interaction between the electron spins and the lattice nuclear spins. All such subtle phenomena can be (and actually were) studied by small research groups at A.F. Ioffe Institute in Leningrad and at Ecole Polytechnique in Paris. This paper has predicted a new phenomenon: current induced electron spin orientation, now called Spin Hall Effect, and has introduced for the first time the notion of spin current. The phenomenon is related to the Anomalous Hall Effect in ferromagnets, which was discovered by Hall himself in 1881, remained a mystery during about 70 years, and is not yet fully understood even today. Simply speaking, due to the spin-orbit interaction the flow of spin-up electrons is deviated, say, to the right, while the flow of spin-down electrons is deviated to the left - in full analogy with what happens to a rotating tennis ball (the Magnus effect). In a ferromagnet, the electrons are spin- polarized, thus in the presence of current they will be predominantly deviated sideways, perpendicular to the directions of both current and magnetization, creating a quasi Hall voltage. In a nonmagnetic conductor, the spin polarization is absent, however this "Magnus effect"still exists, though it does not lead to the appearance of a net electric current. Instead, it gives rise to a spin current: spins-up go to the right, while spins-down go to the left. This does not produce any observable effects in the bulk of the conductor, however it leads to spin accumulation at the lateral boundaries. As a result, spin polarization (of opposite signs) should appear at these boundaries. This prediction did not attract much interest at the time (although the so-called "inverse spin Hall effect"was discovered [4]), mainly because experimental means were lacking to measure the relatively weak spin polarization in narrow ( $1\mu m$) surface layers. The situation has changed 30 years later, when highly sensitive methods for registration of spin polarization were developed, based on Faraday (or Kerr) rotation. In 2004 the current-induced spin polarization predicted in this paper was observed experimentally for the first time [5]. Since then, hundreds of experimental and theoretical publications were devoted to the spin Hall effect. It was observed not only in semiconductors, but also in metals, at cryogenic as well as at room temperature. See the review chapter [6] for more details. The hopes for practical applications of this phenomenon rely mainly on the possibility of switching magnetic domains by injecting spin currents in ferromagnetic films.

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