

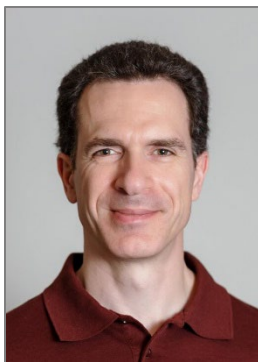


**College of Natural Sciences
& Mathematics**

UNIVERSITY OF DENVER

Physics & Astronomy Colloquium

May 14, 4:00pm, Olin 105



Dr. Kirill Belashchenko

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Unconventional Spin Currents and Torques in Metallic Heterostructures

Current-induced spin-orbit torque enables electric control of magnetization in spintronic devices. I will start by discussing the basic phenomenology and mechanisms of spin-orbit torque. I will then discuss first-principles calculations of spin transport and spin-orbit torques in disordered films and multilayers using the nonequilibrium Green's function technique [1]. Of particular interest is the generation of spin-orbit torque with unconventional spin polarization that can enable the switching of magnetization perpendicular to the film plane; this requires certain symmetries to be broken. I will discuss unconventional torques in ferromagnet/nonmagnet/ferromagnet trilayers [2], as well as spin currents generated by the so-called spin-splitter effect in altermagnets [3] and anisotropic ferromagnets [4], which could be harnessed for this purpose.

[1] K. D. Belashchenko, A. A. Kovalev, and M. van Schilfgaarde, Phys. Rev. Materials 3, 011401(R) (2019); Phys. Rev. B 101, 020407(R) (2020)

[2] V. P. Amin, G. G. Baez Flores, A. A. Kovalev, and K. D. Belashchenko, Phys. Rev. B 110, 214427 (2024)

[3] K. D. Belashchenko, Phys. Rev. Lett. 134, 086701 (2025)

[4] K. D. Belashchenko, Phys. Rev. B 109, 054409 (2024)