



School of Nano Science (IPM)



Condensed Matter & Statistical  
Physics Group (IPM)

## Weekly Webinar

### Interface Engineering of Magnetic Properties in Heavy-Metal/Ferromagnet Bilayer Devices

Speaker: **Dr. Farzad Mahfouzi**

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Spin-Orbit Interaction (SOI) is a relativistic effect that is central to describing magnetization dynamics in continuum limit where the focus is on the slow variation of magnetization order parameter. Magneto-Crystalline Anisotropy (MCA), intrinsic Gilbert damping and Dzyaloshinskii-Moriya Interaction (DMI) are some of the most important properties of ferromagnets (FMs) that are responsible for coupling to the crystallographic anisotropy, energy loss and noncollinear ground state spin texture, respectively. SOI can also be employed in conducting nonmagnetic (NM) materials to convert charge bias into spin current and vice versa. The generated spin current can be used to manipulate the magnetization orientation of an adjacent FM through Spin-Orbit Torque (SOT) mechanism. The efficiency of the charge to spin current conversion is often improved by employing materials with large spin-orbit coupling. In addition to SOT, the presence of a material with large SOI interfaced with the FM can also result in the introduction of interfacial MCA, Gilbert damping and DMI, all of which are inversely proportional to the thickness of the FM film. In this talk, I present my recent work on the first principles calculations of the effects of sawtooth shaped interface on Magneto-Crystalline Anisotropy (MCA), Spin-Orbit Torque (SOT) and Dzyaloshinskii-Moriya Interaction (DMI) in Heavy-metal(HM)/Ferromagnet(FM) bilayer devices. I show that the breaking of the inplane mirror symmetry due to a sawtooth shaped interface results in an effective reorientation of the Damping-Like (DL) SOT, reorientation of the easy axis and additional nonzero components for DMI tensor elements. The shape of the sawtooth interface can be controlled by the angle of the crystal growth direction, which provides a convenient approach to engineer the interfacial properties of the FM.

**Wednesday, 2 December 2020 (۱۳۹۹ آذر ۱۲), 14:00-15:00**

Virtual Meeting Room (please log in as a guest):

<https://www.skyroom.online/ch/schoolofnanoscience/weeklyseminars>

