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The State of the Art in (Cd,Mn)Te Heterostructures: Fundamentals and Applications[1]

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In my talk I will review recent progress in the MBE technology of (Cd,Mn)Te nanostructures containing two dimensional electron gas (2DEG) that led to the first ever observation of fractional quantum Hall effect in magnetic system [1]. This opens new directions in spintronics. I will first discuss already demonstrated applications of such high mobility magnetic-2DEG system for: a) THz and microwave radiation induced zero-bias generation of pure spin currents and very efficient magnetic field induced conversion of them into spin polarized electric current [2]; b) clear demonstration of THz radiation from spin-waves excited via efficient Raman generation process [3]; c) experimental demonstration of working principles of a new type of spin transistor based on controlling the spin transmission via tunable Landau-Zener transitions in spatially modulated spin-split bands [4]. I will also explain the possibility to use magnetic-2DEG for developing of a new system where non-Abelian excitations can not only be created, but also manipulated in a two-dimensional plane. The system is based on high mobility CdTe quantum wells with engineered placement of Mn atoms, where sign of the Lande g-factor can be locally controlled by electrostatic gates at high magnetic fields. Such a system may allow for building a new platform for topologically protected quantum information processing. I will also present results demonstrating electrostatic control of 2D gas polarization in a quantum Hall regime [5].

[1] C. Betthausen, *et al.*, Phys. Rev. B **86**, 085310 (2014).
[2] P. Olbrich, *et al.*, Phys. Rev. B **86**, 085310 (2012).
[3] R. Rungsawang, *et al.*, Phys. Rev. Lett. **110**, 177203 (20130.
[4] C. Betthausen, *et al.*, Science **337**, 324 (2012).
[5] A. Kazakov, *et al.*, APS March Meeting 2015, http://meetings.aps.org/link/BAPS.2015.MAR.A7.13.

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