# Magnetic Properties in 2D Intercalated Disulfides and Layered Manganites

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# Introduction

- ETH Zuerich, Prof. Loeffler
- PSI and ILL, Martin Boehm and Juerg Schefer
- INTAS project: New Layered $3d$-Materials for Spintronics
- Team: Krasnoyarsk, Novosibirsk, Warsaw, PSI and ILL

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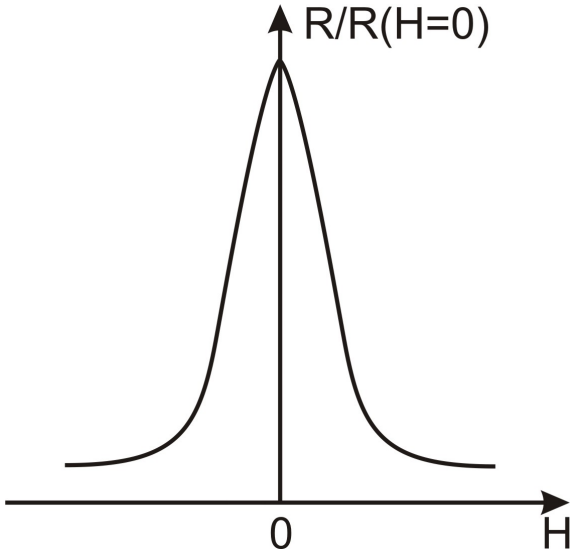
Workshop in Krasnoyarsk, March 20 - 23, 2007

# Motivation

- spintronics based on the phenomenon of colossal magnetoresistance (CMR)
- relative change in electrical resistance on the application of a magnetic field



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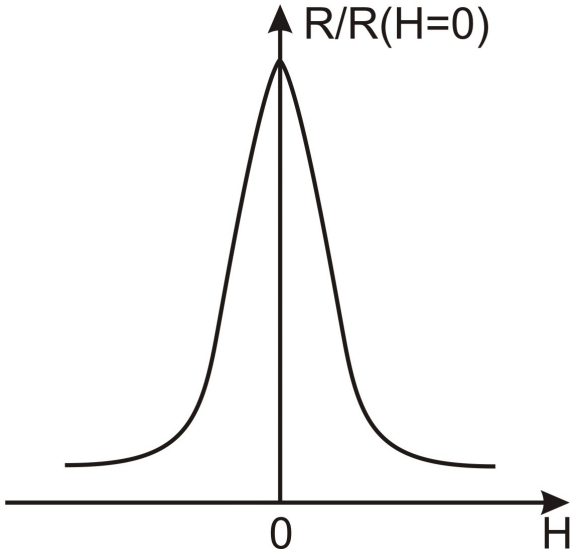


- solid state electronics: non-volatile MRAMs* or high-frequency diodes** controlled by external magnetic field
- basic element of microelectronic devices: multilayer thin film structures → expensive technology!
- solution: quasi 2-dim layered structures
- designing and synthesizing substances by intercalation and cation substitution

* Physics Today **48**,4,353 (1995)
** Nature **402**, 787 (1999)

# Scientific Background

- layered structure characteristic for manganites and transition metal dichalcogenites ($MeX_2$)
- research objects: $Pb_3Mn_{7-x}Me_xO_{15}$ (Me = Ru, Fe, Ga,...) and $CuMe_xCr_{1-x}S_2$ (Me = V, Fe)

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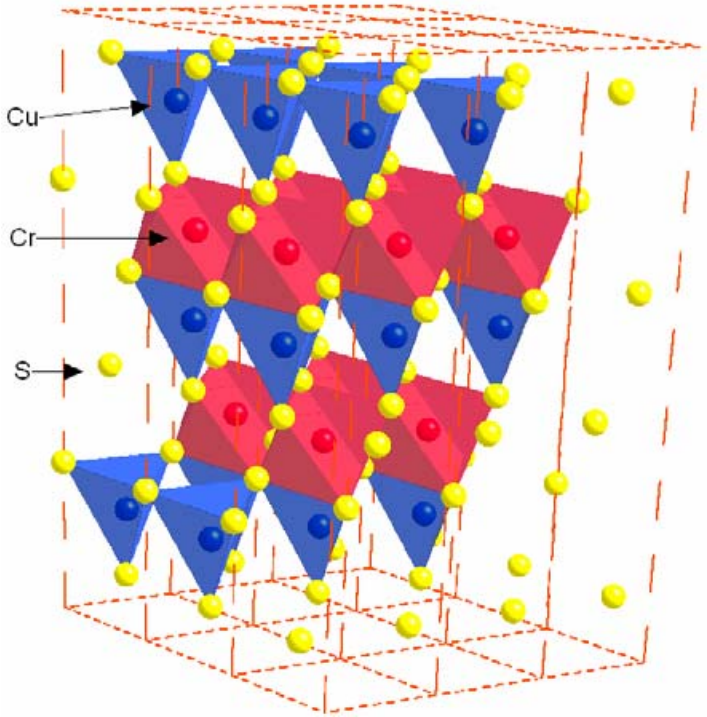
- $MeX_2$ consists of X-Me-X trilayers separated by a van der Waals gap
- $CuCrS_2$: cations ferromagnetically ordered in layers, antiferromagnetically between the layers




* phys. stat. sol. (c) **3**, 2775 (2006)

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# Thesis Objectives

- single crystal and powder neutron diffraction $\rightarrow$ different magnetic structures of $Pb_3Mn_{7-x}Me_xO_{15}$ and $CuMe_xCr_{1-x}S_2$
- influence of chemical and magnetic variations on transport properties
- development of *in situ* transport measurements inside cryo-magnetic devices
- magnetic excitation spectra with three-axis spectroscopy $\rightarrow$ nature and anisotropy of magnetic interactions

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Thank you for your attention!