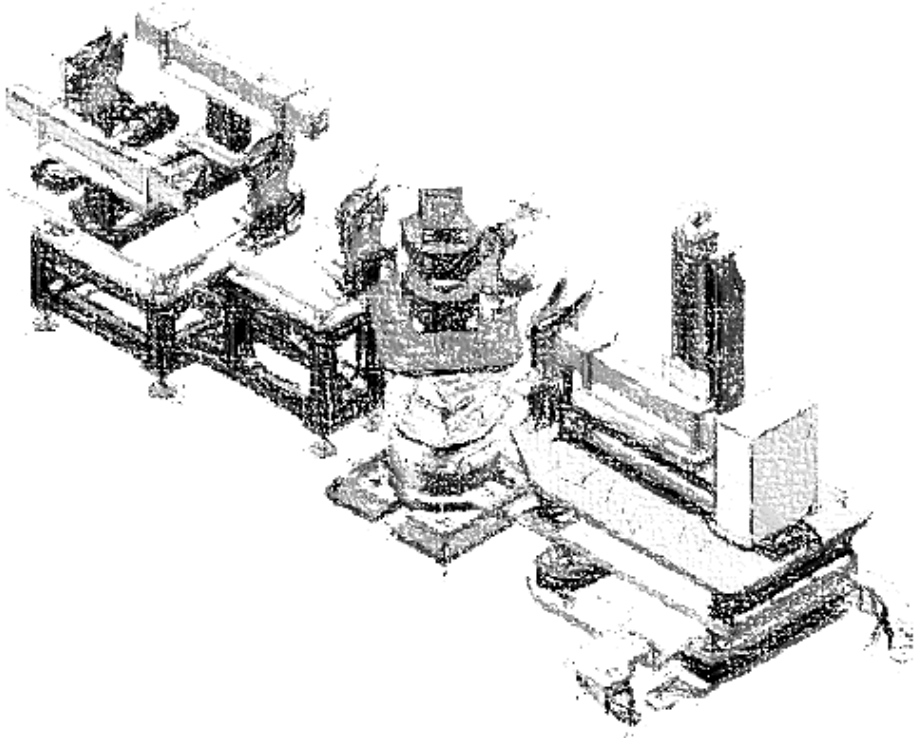
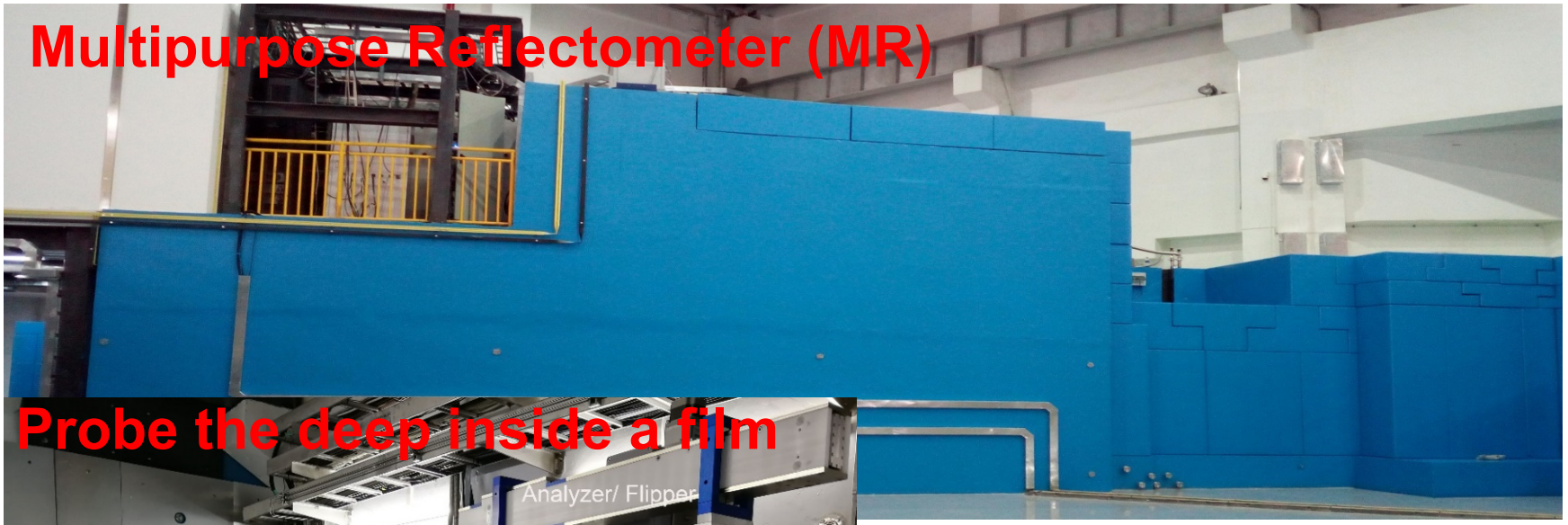
CSNS多功能反射谱仪运行进展

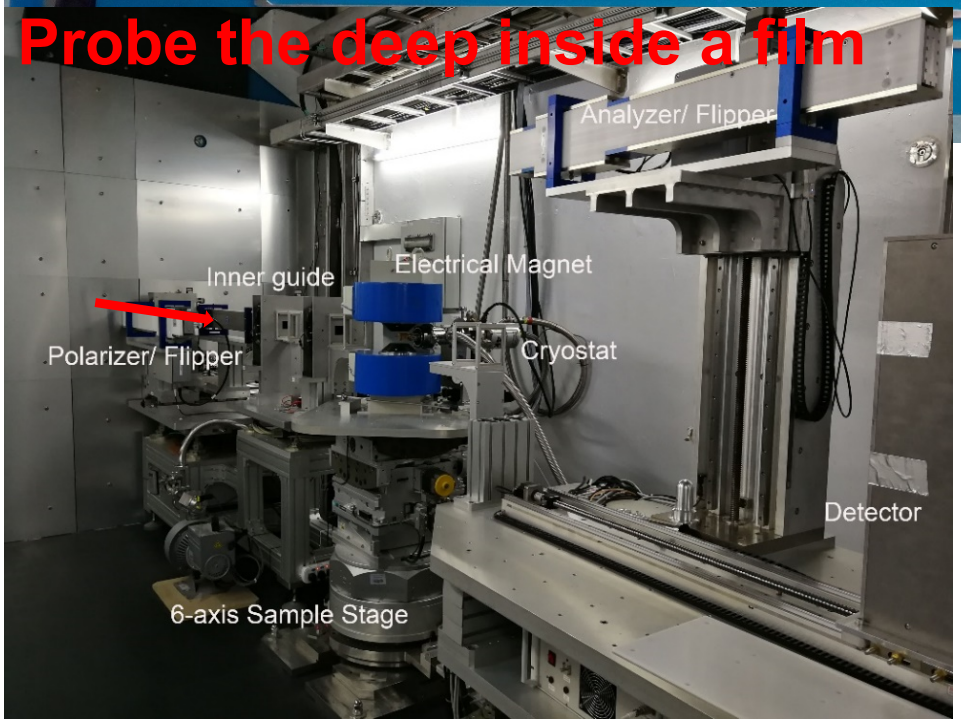
朱涛
中国科学院物理研究所

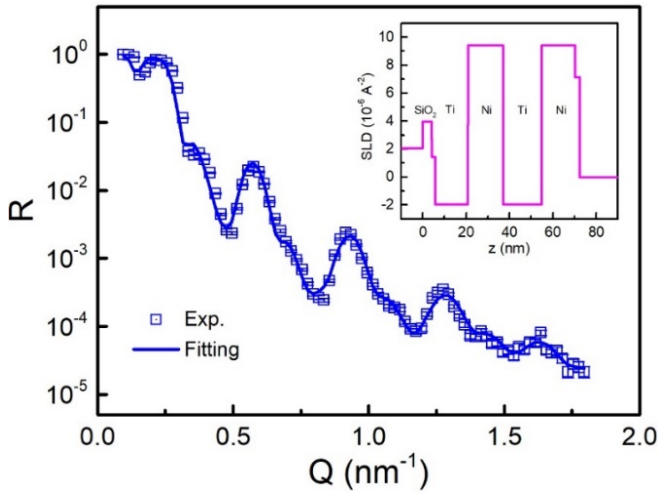
1. 谱仪简介
2. 运行和谱仪改进
3. 应用举例
4. 小结



1. Introduction

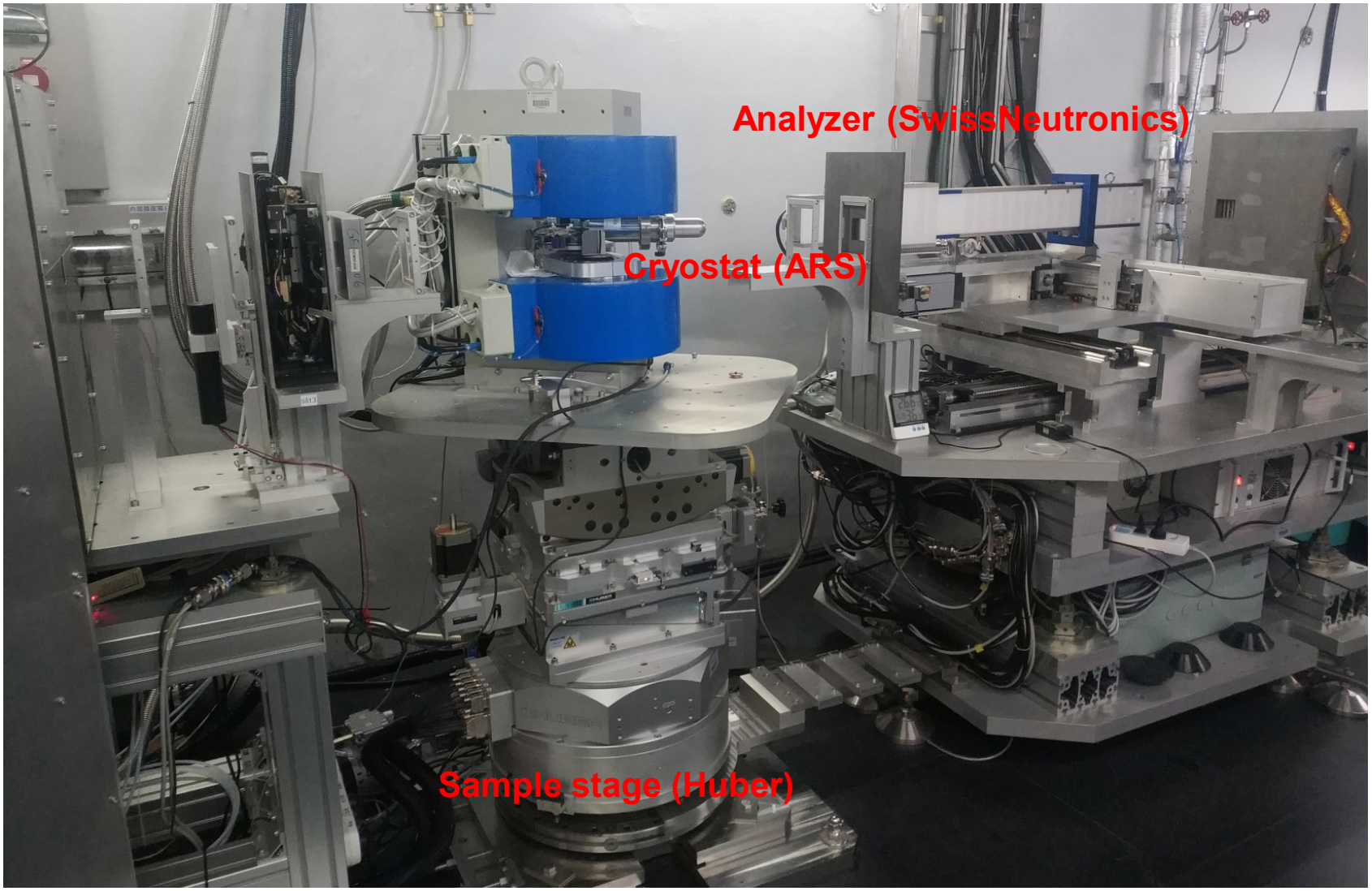




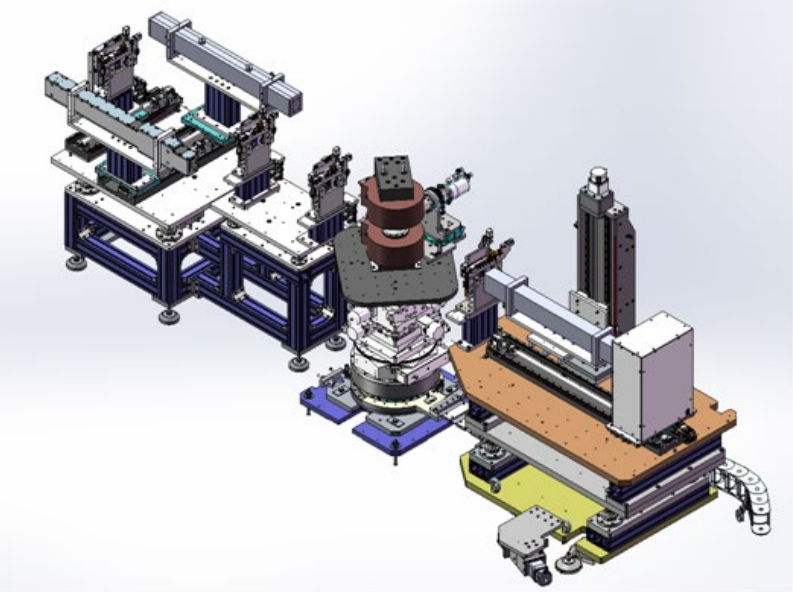


Neutron News, 29(2), 11 (2018)

CSNS 中子通量最大的谱仪~ 1.18×10^8 n/cm^2/s

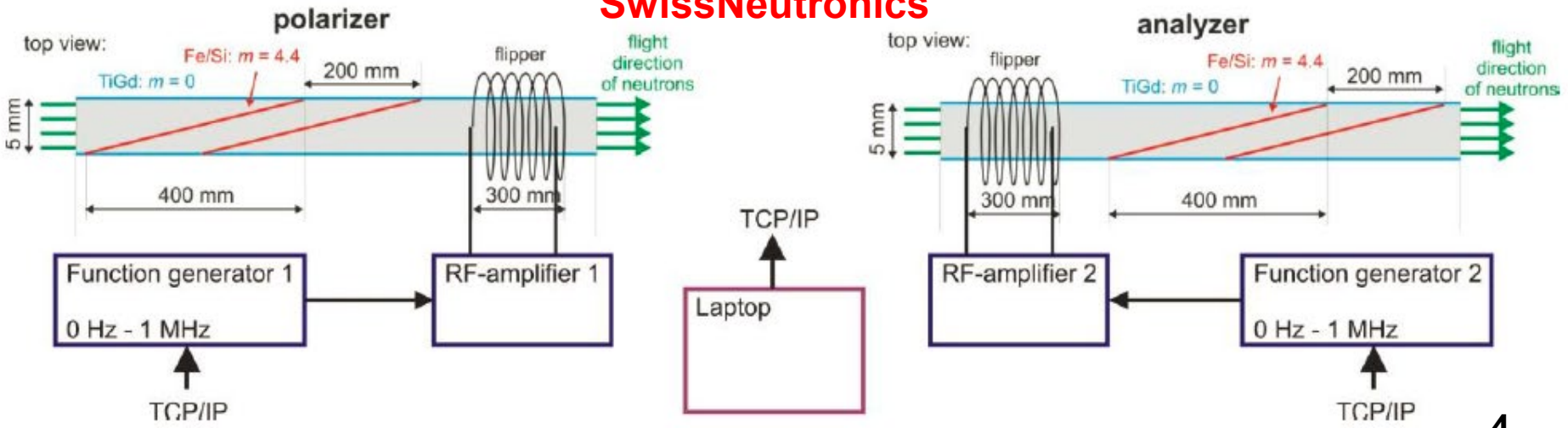


Beamline specifications

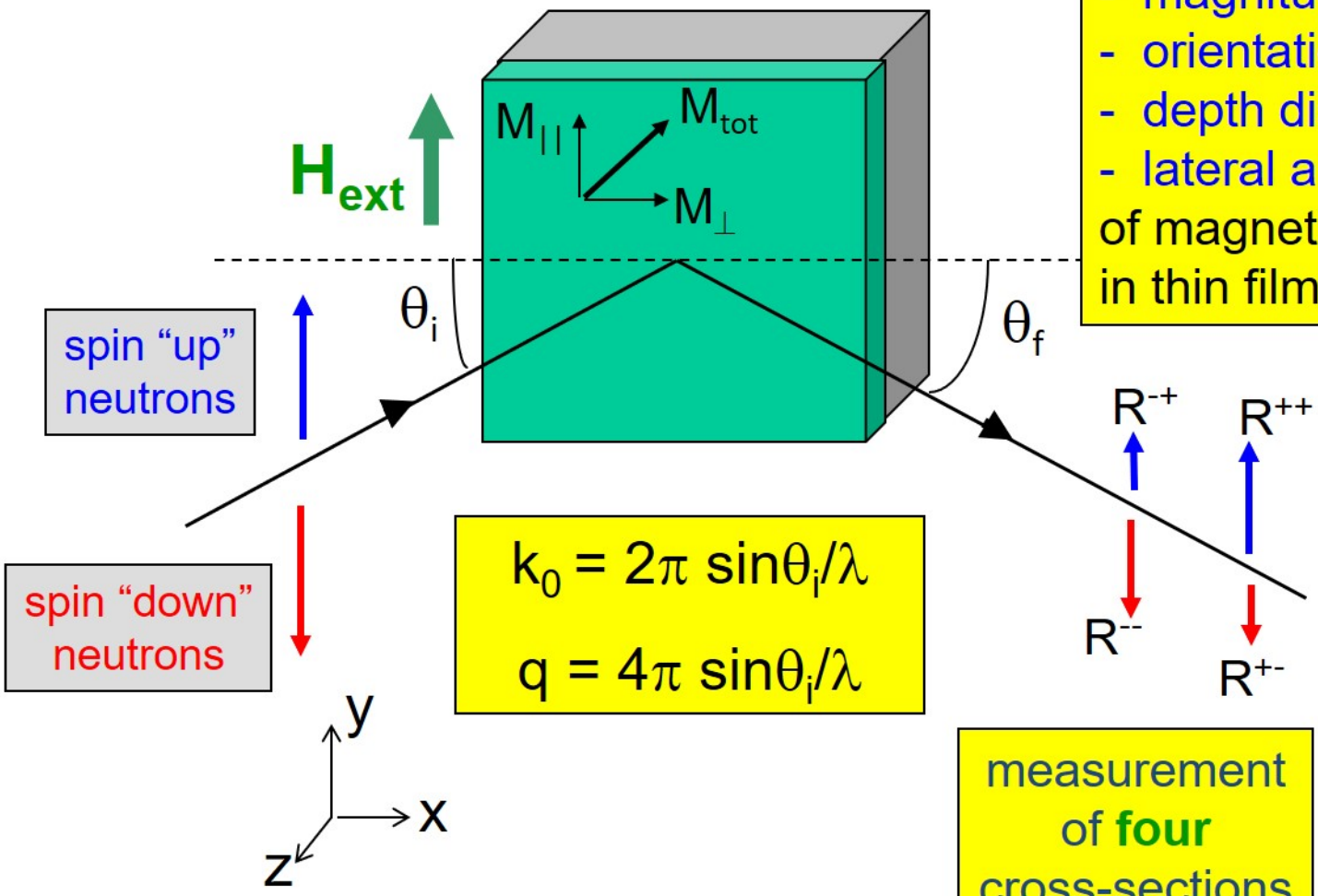


- $Q_{max} \sim 2\ nm^{-1}$;
- $R_{min} \sim 10^{-6}$;
- Flux at sample $\sim 1.18 \times 10^{8}\ n/cm^2/s$;
- ^3He tube;
- Full polarizing package using SM cavity;
- Sample environment @5-750K @1T;
- Sample size: not smaller than $10\times10\ mm^2$, not larger than 2 inch (the best size is around $15\times10\ mm^2$).

SwissNeutronics



Polarized Neutron Reflectometry (PNR)



2. Current status of MR

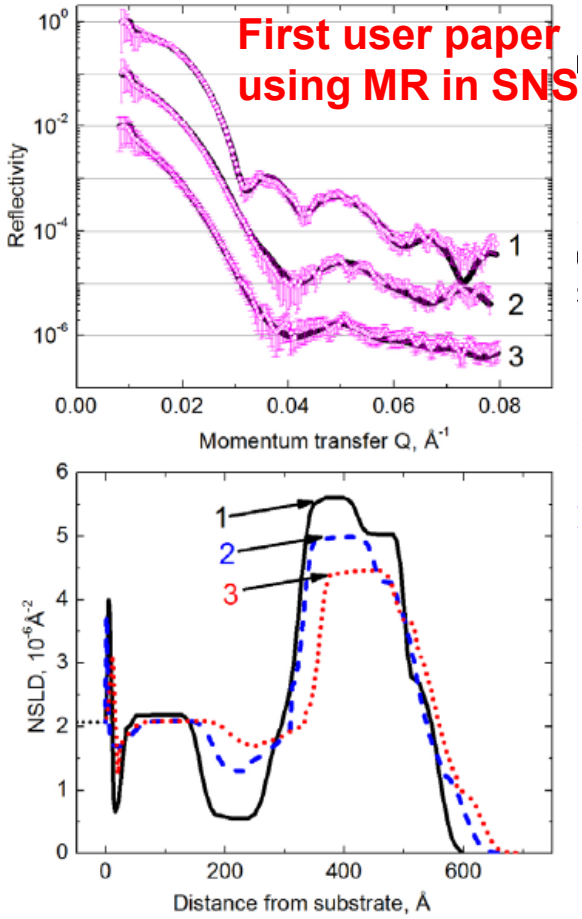
- **11** experiments were finished in the first two circles (2018.11-2019.06).
  10 experiments were finished in the third circle (2019.09-2020.01).
  8 experiments were finished in the last circle (2020.02-2020.07).
- **14** papers have been published or accepted until October in 2020.

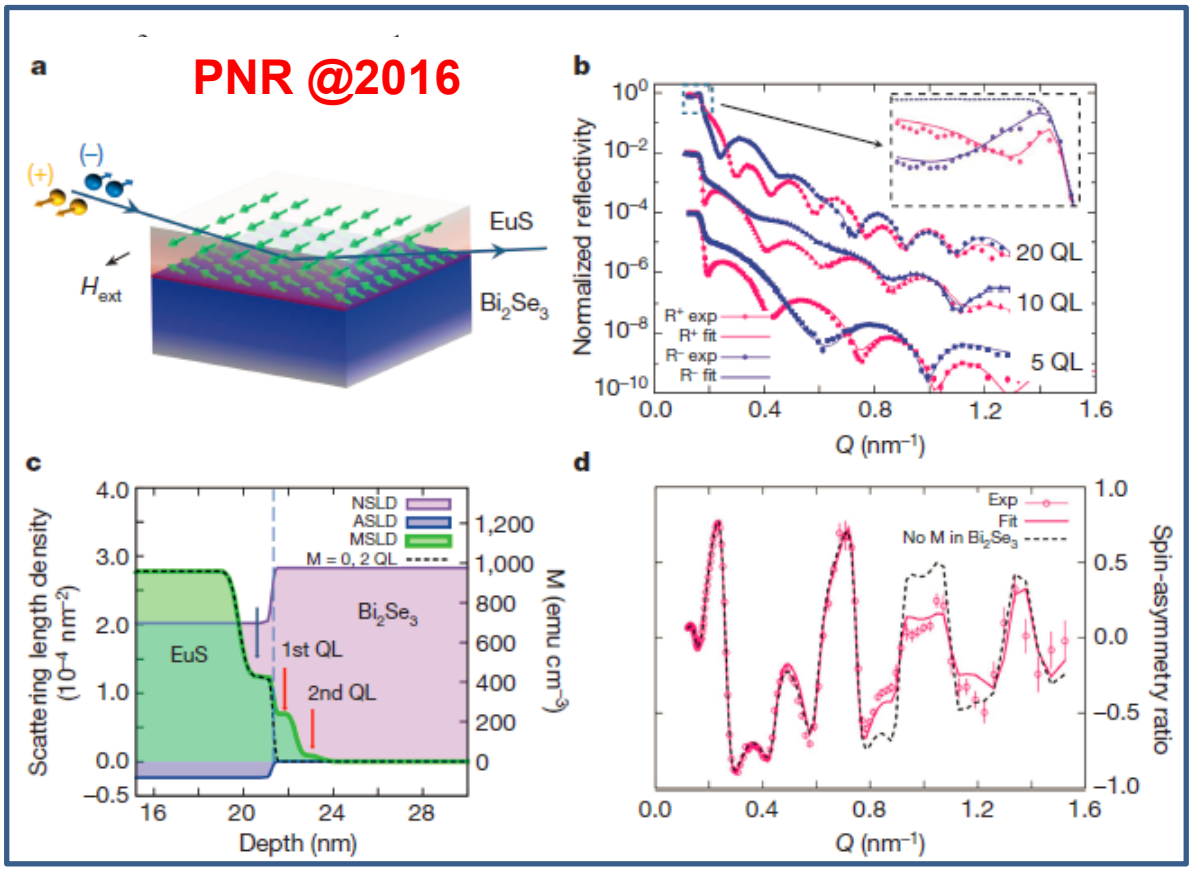
	供束机时	机器研究	故障	用户实验	
2019-2nd	2129	527	31	1571	73.8%
2020-1st	2558	435	13	2110	82.5%
	4687			3681	78.5%

	研究领域	文章数	备注
2020	自旋电子学	2	Phys. Rev. Research/ Adv. Mater.
	氧化物	4	Phys. Rev. B/ Natl. Sci. Rev. Nano Energy/ Adv. Mater.
	软物质	2	ACS Appl. Mater. & Inter/ ACS Energy Lett.

IOP PUBLISHING JOURNAL OF PHYSICS: CONDENSED MATTER
J. Phys.: Condens. Matter **23** (2011) 254215 (6pp) doi:10.1088/0953-8984/23/25/254215

Morphology of thin nanocomposite films of asymmetric diblock copolymer and magnetite nanoparticles





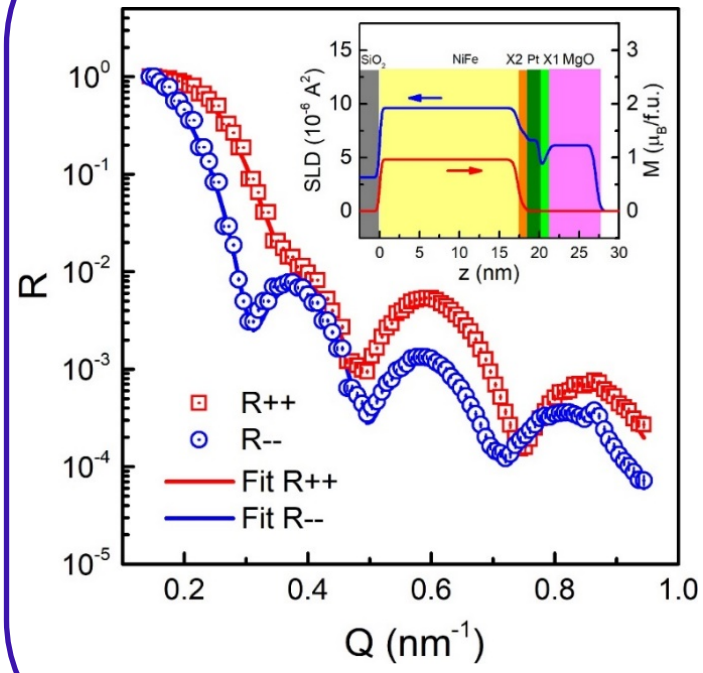
IOP Publishing
Journal of Physics: Condensed Matter
J. Phys.: Condens. Matter 31 (2019) 285801 (7pp)
https://doi.org/10.1088/1361-648X/ab172a

Interface induced enhancement of inverse spin Hall voltage in NiFe/Pt bilayers capped by MgO layer

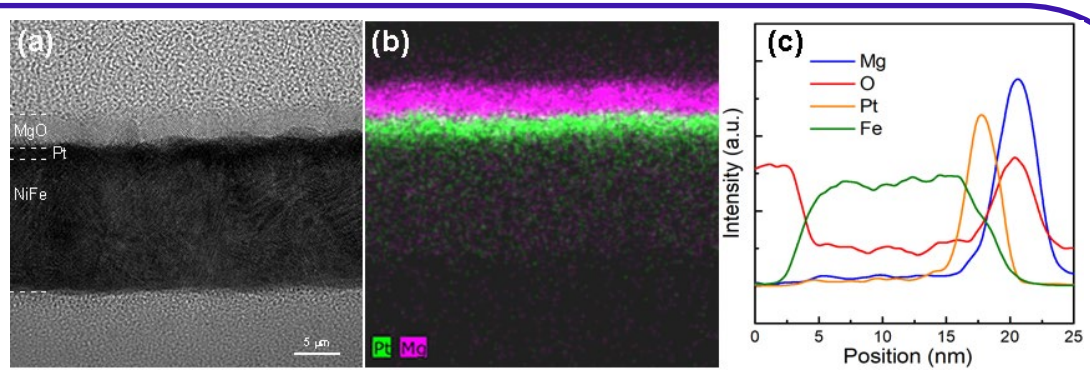
T Zhu[1,2,3,4], F F Chang[3] and X Z Zhan[3]

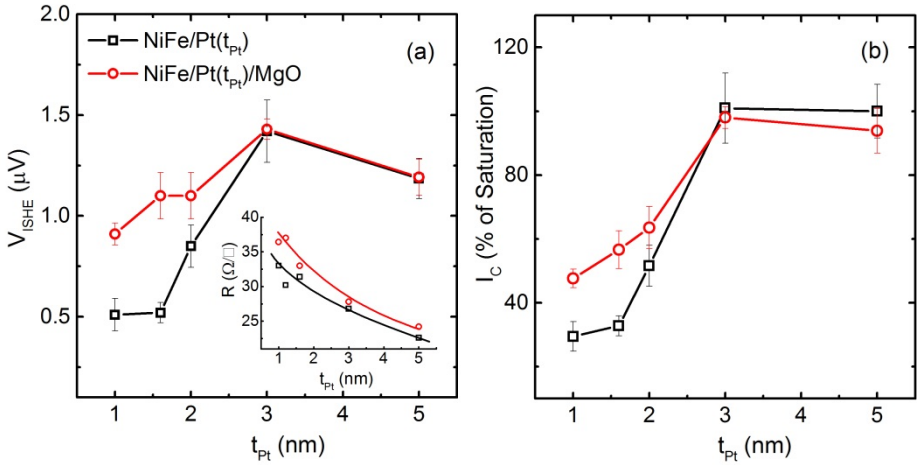
First PNR paper using Reflectometer in China

PNR@2018.07



NiFe(17.5)/Pt(1.6)/MgO(6)

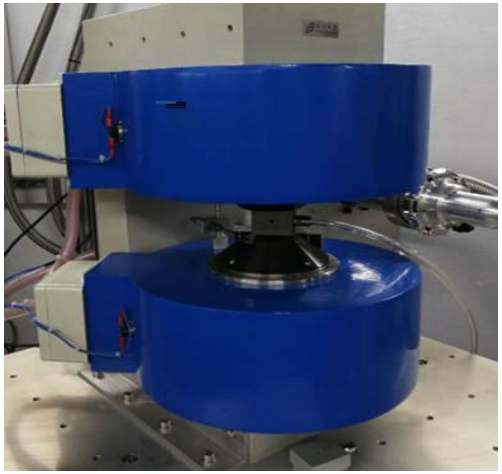




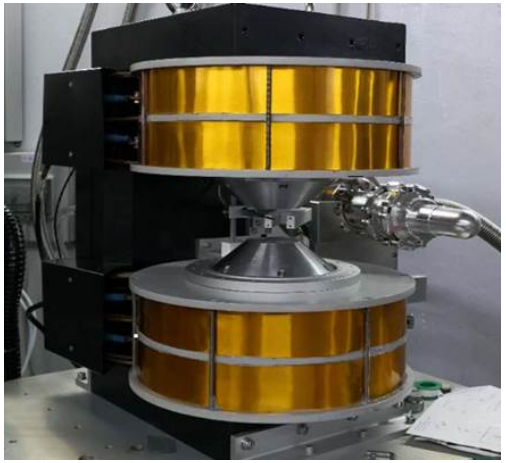
谱仪性能提升

磁场样品环境

➢问题：电磁铁发热严重，接头和管路老化，磁场难以达到 **1T**



➢进展：更换新电磁铁，发热问题解决，最高磁场可达 **1.2T**



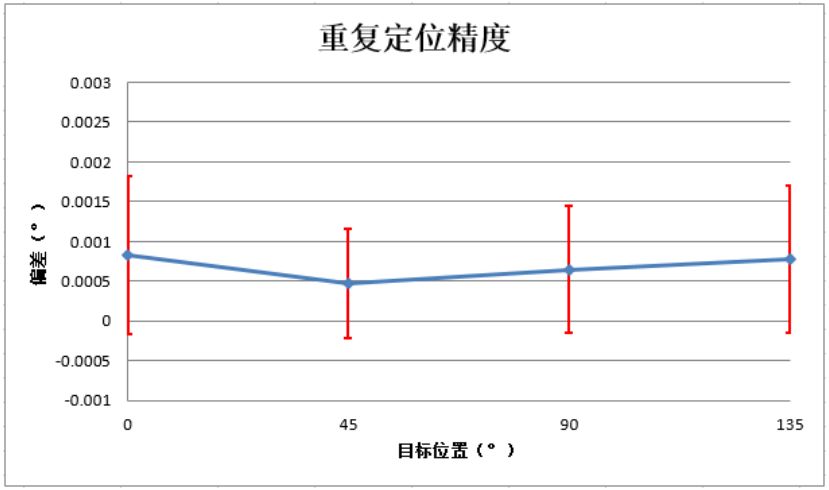
	测试电流	实际磁场	表面温度	报警温度
旧磁铁	70 A	0.9 T	58 ℃	60 ℃
新磁铁	65 A	1 T	33 ℃	60 ℃

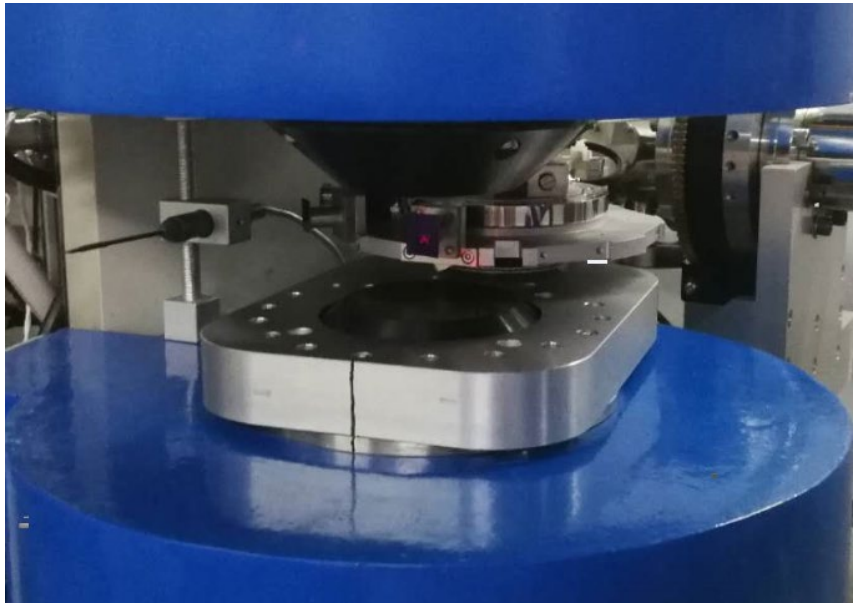
自动换样平台

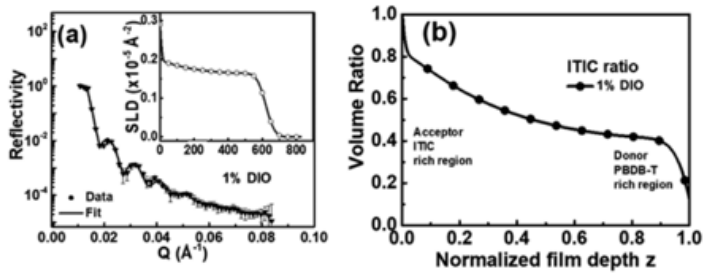
➢问题：对于非极化中子反射的测量，测量时间短，换样次数多

➢进展：研制了薄膜样品的自动换样器，通过调试优化运动参数，重复定位精度小于**0.003°**

➢室温自动换样器投入使用，一次可安装四个样品，帮助用户实验顺利进行。







ACS APPLIED MATERIALS & INTERFACES
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Research Article

Quantitative Determination of the Vertical Segregation and Molecular Ordering of PBDB-T/ITIC Blend Films with Solvent Additives

Li-Ming Wang, Qingduan Li,* Shengjian Liu, Zhixiong Cao, Yue-Peng Cai, Xuechen Jiao,* Haojie Lai, Weiguang Xie, Xiaozhi Zhan, and Tao Zhu*

3. Applications

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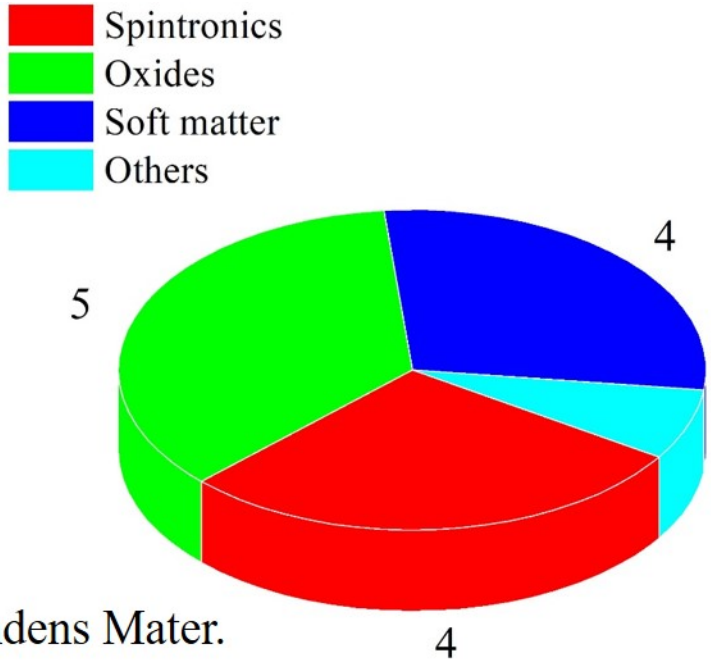

1 Appl. Phys. Lett.
1 Phys. Rev. B
1 Natl. Sci. Rev.
1 Nano Energy
1 Adv. Mater.

1 Angew. Chem.
2 ACS Appl. Mater. Interface
1 ACS Energy Lett.

1 **1** Appl. Phys. Surf.

1 J. Phys.: Condens Mater.
1 Sci. Rep.
1 Phys. Rev. Research
1 Adv. Mater.

唯一可以研究磁性薄膜内部的实验手段

COMMUNICATION

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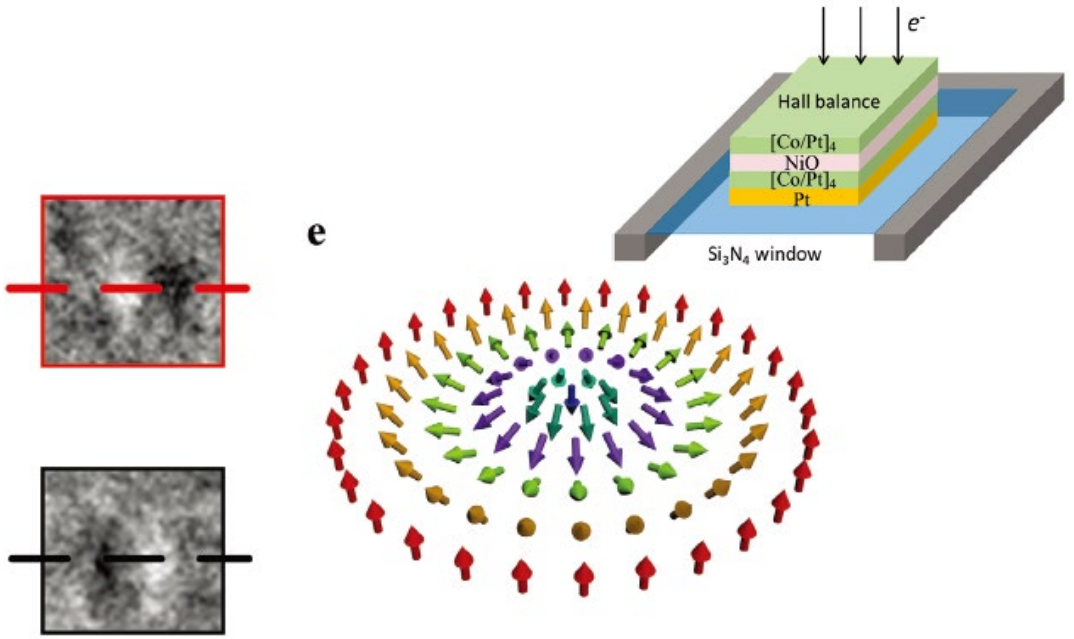
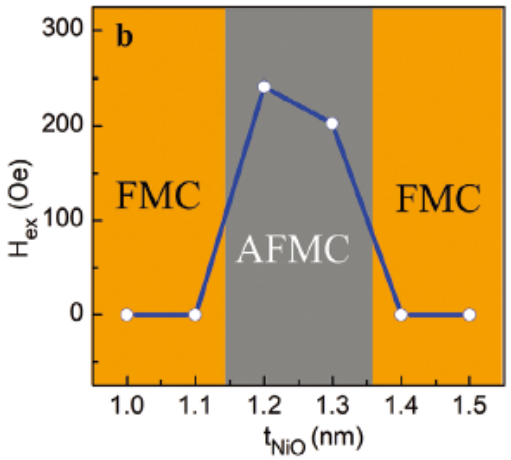
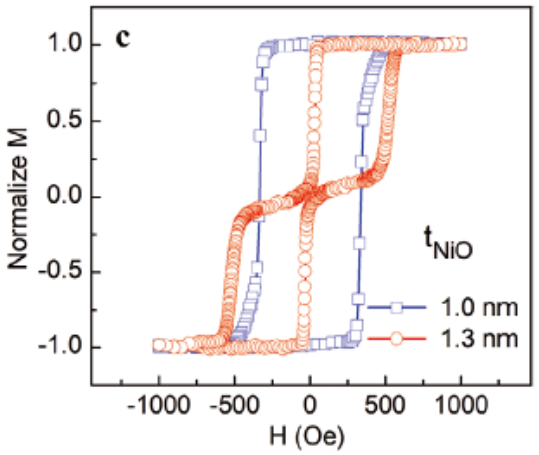
Magnetic Skyrmions in a Hall Balance with Interfacial Canted Magnetizations

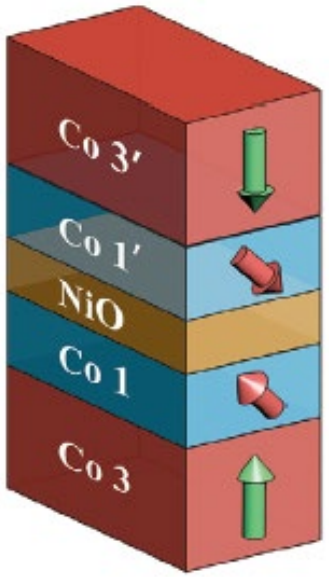
Jingyan Zhang, Ying Zhang, Yang Gao, Guoping Zhao, Lei Qiu, Kaiyou Wang, Pengwei Dou, Wenlin Peng, Yuan Zhuang, Yanfei Wu, Guoqiang Yu, Zhaozhao Zhu, Yunchi Zhao, Yaqin Guo, Tao Zhu, Jianwang Cai, Baogen Shen, and Shouguo Wang**

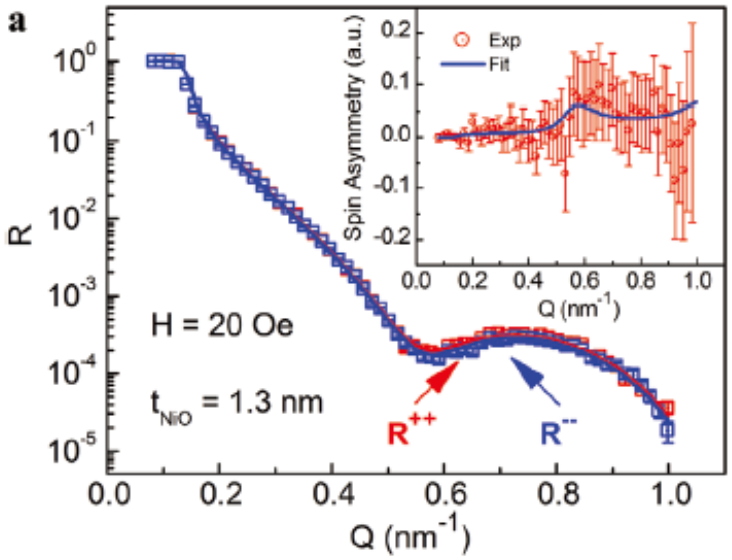


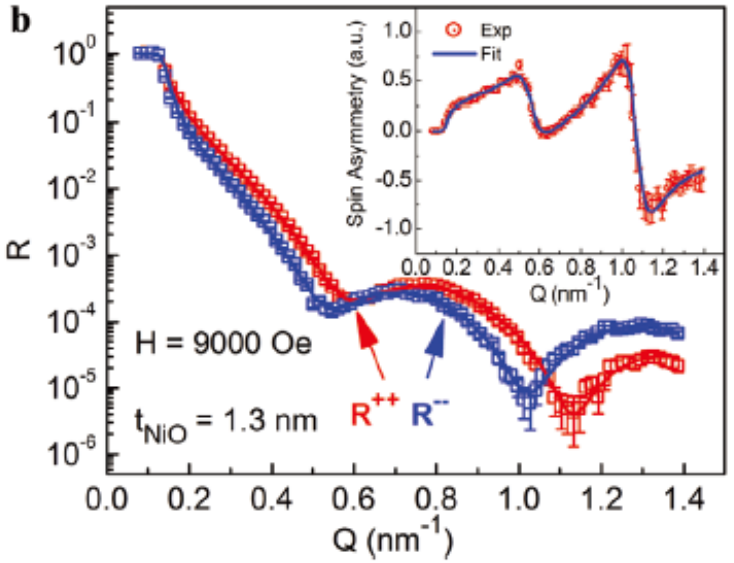
唯一可以研究薄膜内部磁性的实验手段











Adv. Mater. **2020**, 1907452

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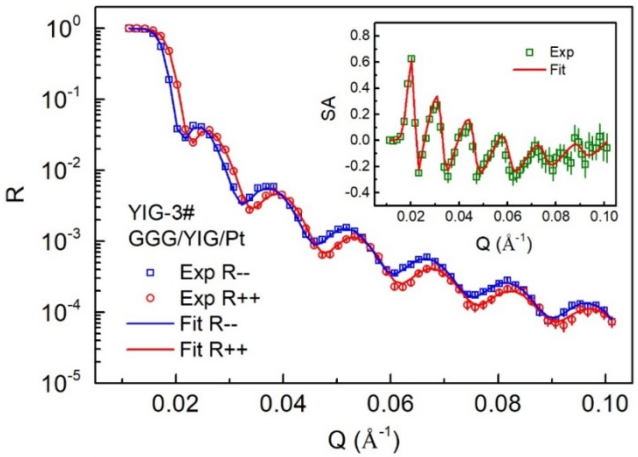
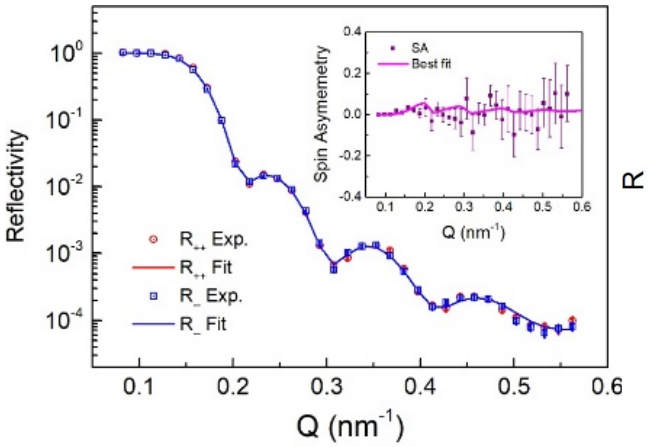
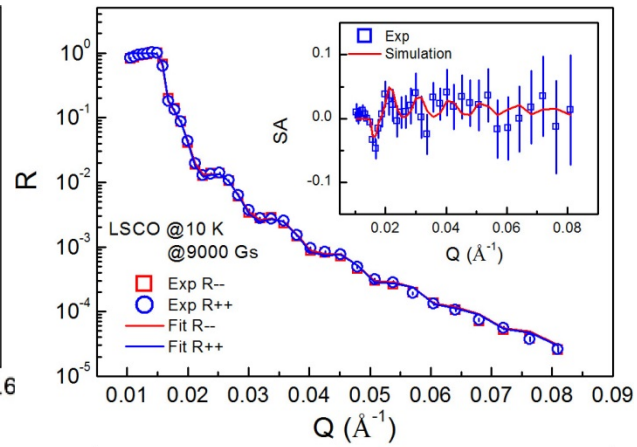
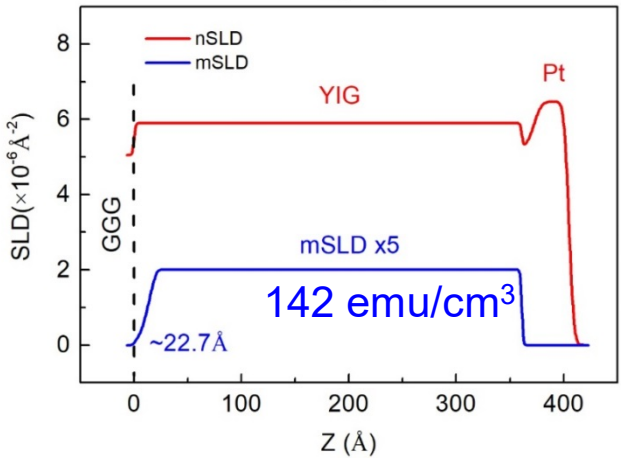
氧化物薄膜磁性的研究

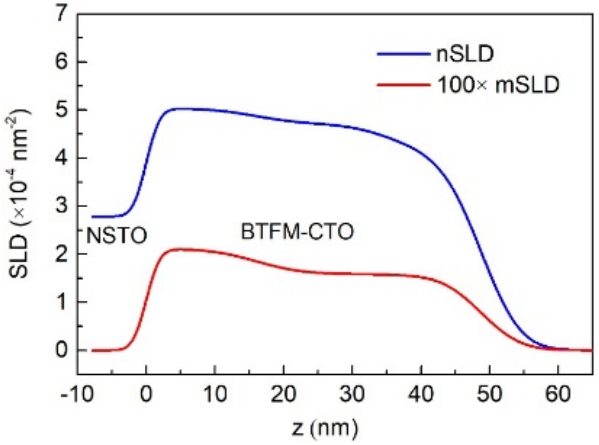
$$SA = \frac{R^{++} - R^{--}}{R^{++} + R^{--}}$$

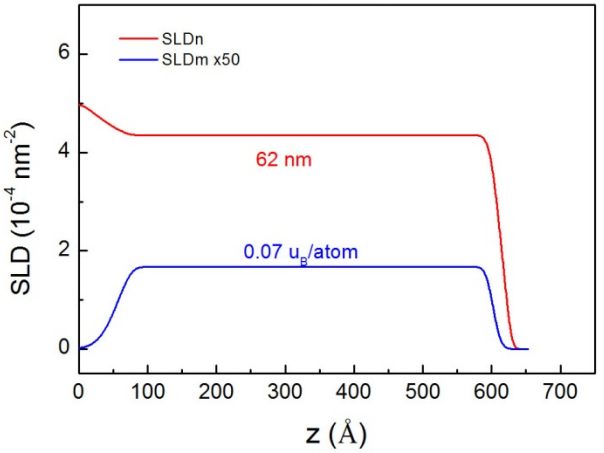












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115,182401 (2019)

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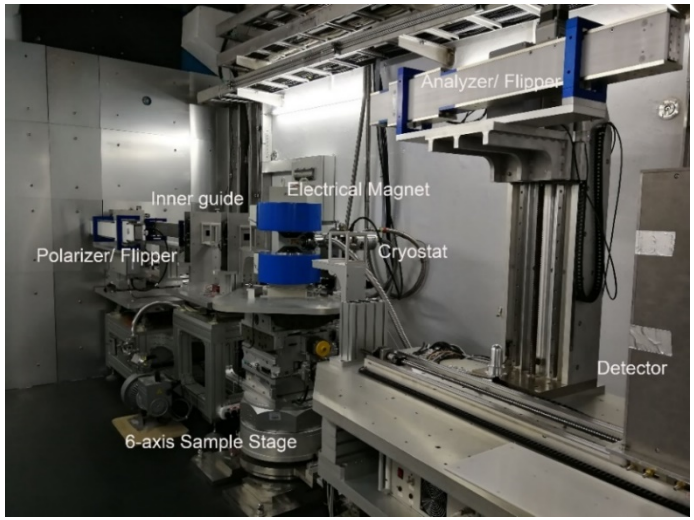
4. Conclusions and Outlooks

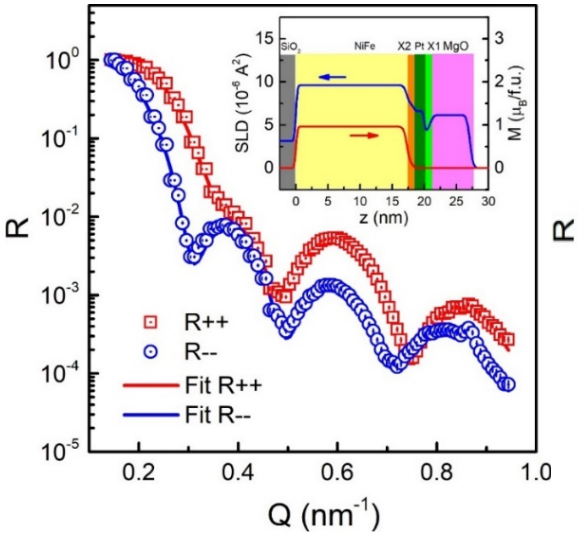
1. MR目前已经建成为CSNS(中子散裂源)中子通量最大的谱仪，为进一步实现其多功能的目标奠定了坚实的基础。

2. MR的调试难点在于运动和测量的结合，在各方面的努力下，在时间有限的国家验收阶段基本调试完成，实现了全面向用户开放。

2017



2018



2019