



### Weekly Seminar

## The Synthesis, $\mu$ SR and NMR Investigation of Novel Diluted Magnetic Semiconductors

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**Time: 4:00pm, April 6, 2016 (Wednesday)**

**时间: 2016年4月6日 (周三) 下午4:00**

**Venue: Room w563, Physics Building, Peking University**

**地点: 北京大学物理楼, 西563会议室**

### Abstract

The research of DMS has been mostly confined to MBE-grown thin films. Recently, our collaboration team fabricated many bulk form DMSs that are derivatives of Fe-based superconductors, i.e., “111” DMS system I-II-V Li(Zn,Mn)As with  $T_C \sim 50$  K [1], “122” DMS system (Ba,K)(Zn,Mn)<sub>2</sub>As<sub>2</sub> with  $T_C \sim 230$  K [2,3], “1111” DMS system (La<sub>1-x</sub>Ba<sub>x</sub>)(Zn<sub>1-x</sub>Mn<sub>x</sub>)AsO with  $T_C \sim 40$  K [4], etc. These ferromagnets are all p-type, and have the advantage of decoupled spin and charge doping. In this talk, I will give an introduction of these novel DMSs, and talk about our  $\mu$ SR and NMR results on Li<sub>(1+y)</sub>Zn<sub>(1-x)</sub>Mn<sub>x</sub>P that has a cubic structure identical to that of III-V (Ga,Mn)As and II-VI (Zn,Mn)Se. Our experimental results [5, 6] confirmed the ferromagnetism in Li<sub>(1+y)</sub>Zn<sub>(1-x)</sub>Mn<sub>x</sub>P is homogeneous and intrinsic.  $\mu$ SR results indicate that the mechanism responsible for ferromagnetic ordering in Li<sub>(1+y)</sub>Zn<sub>(1-x)</sub>Mn<sub>x</sub>P is the same as that of (Ga,Mn)As [6]. NMR results establish that Mn-Mn ferromagnetic interactions are not limited to the near-neighbor sites, but extend over many unit cells, mostly likely due to the p-d Zener interactions [5]. Our research on FeAs-derived compounds has attracted attentions for studies of interplay between p-d Zener ferromagnetism, antiferromagnetism, superexchange and superconductivity [7].

- [1] Z. Deng, **F.L. Ning** and C.Q.Jin\* et al, N.C. 2, 422, (2011).
- [2] K. Zhao, **F.L. Ning** and C.Q.Jin\* et al, N.C. 4, 1442, (2013).
- [3] K. Zhao and C.Q. Jin\* et al, Chin. Sci. Bull. 59, 2524, (2014).
- [4] C. Ding and **F.L. Ning**\* et al, PRB, 88, 041102(R), (2013).
- [5] C. Ding and **F.L. Ning**\* et al, PRB, 88, 041108(R), (2013).
- [6] **F.L. Ning**\* and H.Y. Man et al, PRB 90,085123 (2014).
- [7] T. Dietl and H. Ohno, RMP, 86, 187 (2014).

### About the speaker

宁凡龙, 浙江大学教授, 博士生导师。2000年在吉林大学物理系获得学士学位, 2009年在McMaster大学获得博士学位, 随后在Columbia大学从事博士后研究。2010年9月受聘于浙江大学物理系, 任特聘研究员。主要运用核磁共振(NMR)和缪子自旋共振( $\mu$ SR)等实验手段, 研究强关联电子体系的物理机制, 在Na<sub>x</sub>CoO<sub>2</sub>-yH<sub>2</sub>O体系和铁基超导体、自旋-电荷分离的块材稀磁半导体等研究方面做了一些工作。发表文章50余篇, 被引用1200余次。