复旦大学物理系 物质科学报告

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Spin-based quantum information processing

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As nanotechnology progresses towards the atomic scale, quantum effects will become unavoidable. However, this is not always a nuisance. On the contrary, using quantum resources can make possible surprising improvements in the efficiency over its classical counterpart. For example, quantum information processors (QIPs) use the laws of quantum mechanics for computation, communication, and information storage. Spins feature prominently in most condensed matter proposals for QIPs, either directly being used as computational or storage qubits, or being important sources of decoherence.

In this talk, I will introduce the basics of spin-based quantum information processing by nuclear magnetic resonance, report our experimental progresses on quantum algorithms and quantum simulations, and discuss current, proposed roles and future directions for nuclear magnetic resonance-based QIP. In more details for our experiments, I will focus on solving the problem of integer factorization by quantum algorithms, and simulating exotic many-body quantum systems by quantum simulators. These experiments fully demonstrate the feasibility of small QIPs.

彭新华，女，中国科学技术大学教授，国家杰出青年获得者。中国科学院“百人计划”引进，曾为洪堡学者，2003 年获中国科学院武汉物理与数学研究所理学博士，并获 2003 年度中国科学院院长优秀奖，主要从事核磁共振量子信息处理的实验工作，在 Nat. Phys.、Sci. Adv. 、PRX、PRL 等国际权威杂志上发表 SCI 论文 80 余篇，累计他引约 2500 余次。 曾获中国青年女科学家、中组部万人计划“科技创新领军人才计划”、教育部青年长江学者奖励计划等。