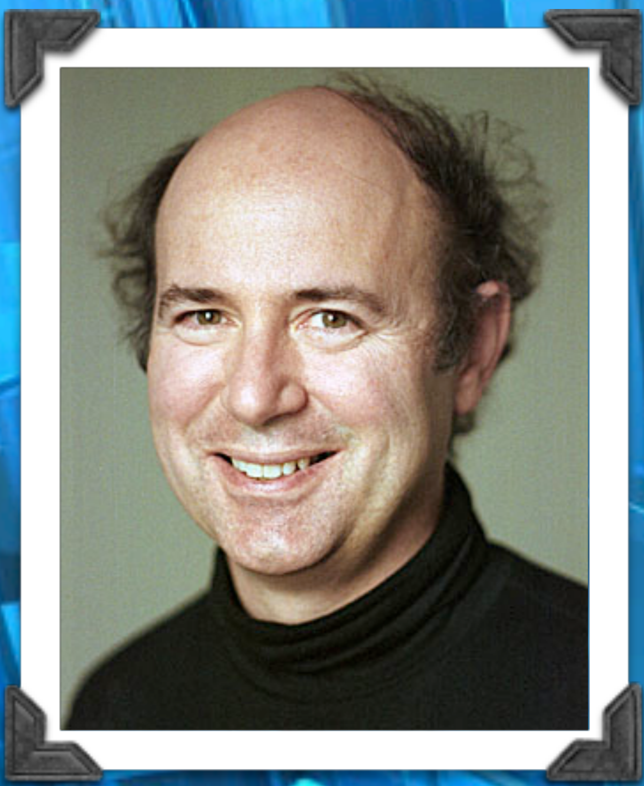
2012年11月27日（星期二）
频标楼3楼报告厅
上午10：30－12:00

尹璋琦博士
清华大学量子信息中心

尹璋琦，湖北孝感人。从1999 年 9 月到 2009 年 12 月，在西安交通大学应用物理系学习，分别获得物理学学士，硕士和博士学位，导师李福利教授。从2007年9月到2009年9月，在美国密歇根大学物理系访问，导师段路明教授。2010年1月至7月在中科院武汉物理与数学所工作，任助理研究员。2010 年 9 月至2012年6月在中国科学技术大学量子信息重点实验室做博士后研究。从2012年7月至今，任清华大学交叉信息研究院助理研究员。尹璋琦博士从事量子信息与量子光学的研究，研究兴趣包括量子信息与量子模拟的物理实现，光机械系统的量子物理特性等。

武汉物数所理论与交叉学术交流系列报告（三十四）

Space-time crystals of trapped ions



Wilczek, who describes the trapped-ion proposal as "much more spelled out and professional" than his own scheme, also argues that space–time crystals could have practical applications, even if it is not clear at this stage what those applications are. "This work is exploring new states of matter", he says, "and could lead in unexpected directions."

Frank Wilczek receives 2004 Nobel Prize in physics.

proposes the concept of space-time crystals in 2012.

Tongcang Li and others (including our speaker) proposed a system with beryllium ions circulating in a magnetic ion trap at about 10^{-9}K, to realize the space-time crystals in 2012.

Frank Wilczek, Phys. Rev. Lett. 109, 160401 (2012)
Tongcang Li et al., Phys. Rev. Lett. 109, 163001 (2012)

http://physicsworld.com/cws/article/news/2012/jul/03/space-time-crystals-on-the-horizon

Space-time crystals of trapped ions

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Great progresses have been made in exploring exciting physics of low dimensional materials in last few decades. Important examples include the discovering and synthesizing of fullerenes (zero dimensional, 0D), carbon nanotubes (1D) and graphene (2D). A fundamental question is whether we can create materials with dimensions higher than that of conventional 3D crystals, for example, a 4D crystal that has periodic structures in both space and time. Here we propose a space-time crystal of trapped ions and a method to realize it experimentally by confining ions in a ring-shaped trapping potential with a static magnetic field. The ions spontaneously form a spatial ring crystal due to Coulomb repulsion. This ion crystal can rotate persistently at the lowest quantum energy state in magnetic fields with fractional fluxes. The persistent rotation of trapped ions produces the temporal order, leading to the formation of a space-time crystal. We show that these space-time crystals are robust for direct experimental observation. The proposed space-time crystals of trapped ions provide a new dimension for exploring many-body physics and emerging properties of matter.