复旦大学物理系 物质科学报告

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Chirality, Vorticity and Magnetic Field in a Subatomic Quantum Fluid

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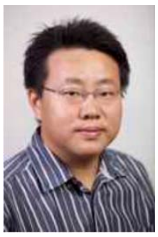
By colliding heavy ions at high energies, physicists are able to ``break up" nuclear particles like protons and neutrons and create a hot ``subatomic soup" — a new form of matter called a quark-gluon plasma (QGP). The QGP forms at a temperature of about one trillion degrees or higher, and briefly occupied the baby Universe. Such primordial environment is now replicated in laboratory at the Relativistic Heavy Ion Collider (RHIC) and the Large Hadron Collider (LHC). Experiments at RHIC and the LHC have opened the door to what I'd call the Quantum-Chromo-Material Science, by revealing and characterizing the fascinating many-body phenomena and properties of strongly interacting matter. Over the past decade, the collider-born QGP is found to be a nearly perfect quantum fluid, sharing many novel behaviors with other strongly correlated quantum systems in atomic and condensed matter physics. In this talk, I will discuss two very recent examples, arising from the nontrivial interplay of the extreme vorticity and magnetic fields with the spin and chirality of the underlying microscopic particles. The first is the global polarization of particle spin from fluid rotation, demonstrating "fluid spintronics" on the subatomic scale. The second is the anomalous transport known as the Chiral Magnetic Effect (CME) that has been enthusiastically studied in Dirac and Well semimetals as well as in atomic, astrophysical and cosmological systems.



Jinfeng Liao received his BS degree in 2001 and MS degree in 2004 from Tsinghua University. He received his PhD from Stony Brook University in 2008. After spending two years as a postdoctoral fellow at Lawrence Berkeley National Laboratory and one year as a Research Associate at Brookhaven National Laboratory, he became an Assistant Professor at Indiana University in 2011, and he was a Physicist Fellow at RIKEN BNL Research Center from 2011 to 2016. He became an Associate Professor at Indiana University in 2017.

Prof. Liao has published over 82 scientific-research papers in the broad area of theoretical nuclear and high-energy physics. These papers have accumulated a total citation of about 2900 and an H-index of 30. He got the Di Tian Prize and the Max Dresden Prize from Stony Brook University in 2006 and 2009, respectively, and he got the CAREER award from NSF in 2014. He was honored for Refereeing Excellence by European Physical Journal in 2014, and by Nuclear Physics A by 2010 and 2012. He is a member of the International Advisory Board for Chirality 2018. He is the convener of the CME Working Group of the BEST Collaboration.