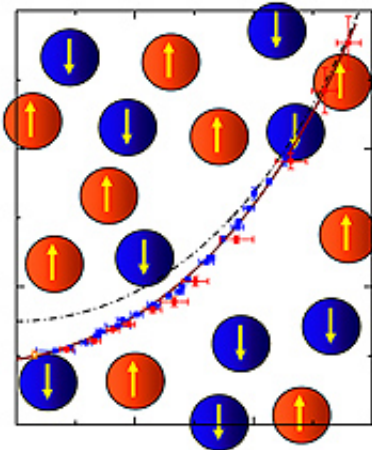


Physicists Observe Universal State

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First published evidence for universal thermodynamics using data from three different strongly interacting Fermi gas experiments, with a schematic background of the interacting particles.

A team of Australian and Chinese scientists have found the first observed evidence for "universality" in a paper to be published in the prestigious *Nature Physics* journal next month.

The finding has been made by the Australian Research Council Centre of Excellence for Quantum-Atom Optics, University of Queensland (UQ) team of Peter Drummond and Xia-Ji Liu in a joint publication with Hui Hu of Renmin University of China (RUC) in Beijing.

Professor Drummond said the central aim of physics was to find simple

descriptions for complex behaviours.

"In normal systems, a particle's behaviour is determined by its type; atoms react differently to protons for example," he said. "However, recent work by our UQ team has shown that for systems with strongly interacting particles (specifically particles such as fermions which like to remain apart) their behaviour does not depend on the type of particle. This behaviour is known as Universal Behaviour."

Last year, theory from the same UQ team, based at UQ's School of Physical Sciences, predicted the properties of this universal matter.

Professor Drummond said three US laboratories had now published measurements of experiments on ultra-cold atoms, under conditions of a very high vacuum and a strong magnetic field, which gave the required universal regime.

"All three experiments, on different types of atom and under different conditions, agree precisely with the theory produced at UQ," he said.

The UQ/RUC team collected data from the three experiments, and showed that all the data lay on a single, universal curve as predicted last year.

"This breakthrough lays the foundation for understanding the universal state, exciting researchers who are trying to better understand high T_c superconductors," Professor Drummond said.

"Much credit must be given to the superb experimental work of John Thomas (Duke University), Debbie Jin (Colorado University) and Randy Hulet (Rice University), in whose laboratories the measurements were carried out."

Similar experiments are now underway in Swinburne University of Technology in Melbourne, also part of the ARC Centre of Excellence for Quantum-Atom Optics.

The paper published in Nature Physics can be accessed at Nature Physics [online](#).

Source: University of Queensland

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