



Seminar

Dipolar dimer liquid — a peek of simple and complex faces of water

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Venue: Room W663, Physics building, Peking University

地点: 北京大学物理楼, 西663会议室

Abstract

Water is believed to be an essential element for the lives on the Earth. It is a simple molecule consisting of two hydrogen and one oxygen atoms, whereas it supports the chemical reactions in various biological processes. Among many open problems, a particularly interesting one is to understand what is role of water to help the protein folding.

We try to reveal some nature of the water by using a much simplified model — Dipolar Dimer Liquid (DDL). Particularly, we consider the DDL on a two-dimensional lattice. We found there exists a partially ordered phase (which we called glacia phase) in the low temperature and high density regime. The phase transition may be understood by mapping it to an annealed Ising model on random graphs. The critical temperature is bounded by exactly solvable Ising models. As an application, we further considered polymers in the DDL. In the low temperature and high density limit, the configurational entropy of the DDL may also be exactly calculated, which quantifies the entropic nature of the hydrophobic effect. We found a scaling law of the entropy, which implies the non-trivial role of the water in the protein folding problem.

About the speaker

Junyi Zhang was graduated in 2013 and got his Master degree and Diplôme de l'ENS in 2015. He is now PhD candidate at Princeton University. He is mainly interested in the condensed matter physics. He is currently working on the geometric theory of quantum Hall physics. He has widely spanning research interests from cold atom quantum simulator to electronic processes in biochemical reactions.