מכון ויצמן למדע

THE WEIZMANN INSTITUTE OF SCIENCE

FACULTY OF MATHEMATICS AND COMPUTER SCIENCE

The Chaim Leib Pekeris Memorial Lecture

on Wednesday, Jun 17, 2015
at 11:00

Dolfi and Lola Ebner Auditorium

Stanislav Smirnov
Geneva Univerity & St Petersburg University

The Ising Model of a Ferromagnet from 1920 to the Present Day

Abstract:

The Ising model is an archetypical model of the order-disorder phase transition: though simple to formulate, it exhibits a complex behavior, much like the real-world phenomena in solid-state physics, ferromagnetism, chemistry, biology, computer science.

In 1920 the physicist Wilhelm Lenz proposed to model ferromagnetic materials by a lattice of plus-minus spins with interacting neighbors. His student Ernst Ising solved the model in dimension one four years later. The one-dimensional behavior turned out to be trivial, with no phase transition when the interaction strength changes, and for a decade people searched for other possible models. However, a ferromagnetic phase transition was established by Rudolf Peierls in higher dimensions, and in 1944 Lars Onsager famously calculated the free energy for the Ising model in two dimensions.

Since then the Ising model became widely studied, as it exhibits complicated phase transition behavior, yet allows a very detailed analysis in dimension two. We will give a historical introduction to the model, and then describe some recent results.