

**Stony Brook University
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Doctoral Defense Announcement

Abstract

Statistical mechanics of hard spheres and the two dimensional Ising lattice

By

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In the thermodynamic limit, the pressure of a fluid of hard spheres has a power series expansion in terms of the density. The coefficients of this power series are called virial coefficients. The virial coefficients can be represented in terms of graphs. The coefficients of order four and lower only contain graphs which have been evaluated exactly, but this is not the case for coefficients of higher order. In this defense the exact value of the fourth virial coefficient of a fluid of hard spheres in low odd dimensions will be presented. Furthermore, a systematic way to write the most involved diagram of a general order in terms of certain integrals over some algebraic varieties.

The calculation of the correlation function of the two dimensional Ising lattice is an open problem. The diagonal correlation function is related to the Painlevé VI equation, as shown by Jimbo and Miwa. Wu, McCoy, Tracy and Barouch presented the general correlation function as an infinite series, called the form factor expansion, in 1976. These form factors have awkward integral representations, and is desirable to find an alternative form of the correlation function. In 2006, a new form for the diagonal and row correlation