

Department of Applied Mathematics and Statistics
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SEMINAR

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November 5, 2009
304 Whitehead Hall
Refreshments: 3:30 p.m.
Seminar: 4:00 p.m.

**SELF-DUAL PLANAR HYPERGRAPHS AND
EXACT BOND PERCOLATION THRESHOLDS**

ABSTRACT

A generalized star-triangle transformation and a concept of triangle-duality have been introduced recently in the physics literature to predict exact percolation threshold values of several lattices. We investigate the mathematical conditions for the solution of bond percolation models, and identify an infinite class of lattice graphs for which the exact bond percolation thresholds may be rigorously determined as the solution of a polynomial equation. This class is naturally described in terms of hypergraphs, leading to definitions of planar hypergraphs and self-dual planar hypergraphs. We show that there exist infinitely many self-dual planar 3-uniform hypergraphs, and, as a consequence, that there exist infinitely many real numbers $a \in [0, 1]$ for which there are infinitely many lattices that have bond percolation threshold equal to a .