Department of Theoretical Physics

THE QUANTUM SPACETIME SEMINAR SERIES

O(N), Sp(2M), and OSp(1|2M) Models

(Zoom Seminar)

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Zoom link shall be shared separately

The upper critical dimension of the O(N) vector model is well-known to be 4. In dimension 4-epsilon it is described by the Wilson-Fisher IR fixed point of the O(N) invariant scalar field theory with a small positive quartic coupling. Above 4 dimensions, this theory is non-renormalizable, but in 4+epsilon dimensions it formally has a UV fixed point at small negative coupling. For sufficiently large N, its UV completion in 4<d<6 is the theory of N+1 scalar fields with O(N) invariant cubic interactions. It possesses a weakly coupled IR fixed point in dimension 6-epsilon where the scaling dimensions agree with the 1/N expansion. The scaling dimensions also have imaginary parts that are exponentially small in N; this suggests the existence of near-critical behavior in 5 dimensions.

Replacing N of the scalar fields by 2M anticommuting scalars, we find Sp(2M) invariant fixed points with imaginary coupling constants in dimension 6-epsilon. In the special case M=1 the symmetry is enhanced to OSp(1|2), and we argue that this theory describes the critical behavior of the zero-state Potts model, or equivalently the random spanning forests. We end by discussing the OSp(1|4) invariant fixed point of the field theory with quintic interactions. Its upper critical dimension is 10/3, and the 10/3-epsilon expansion provides estimates of new critical exponents in d=3.

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