Duals of non-abelian spin models: local formulation, low-temperature asymptotics and continuum limit

Presenter: Oleg Borisenko
O. Borisenko, V. Kushnir

Abstract: Non-abelian lattice spin models with symmetry group $SU(N)$ or $U(N)$ can be formulated in terms of link variables which are subject to the Bianchi constraints. Using this representation we derive exact and local dual formulation for the partition and correlation functions of such models on a cubic lattice in arbitrary dimension D. The construction is used to study in details the dual of $SU(2)$ principal chiral model in two dimensions. In particular, leading terms of the asymptotic expansion of the dual Boltzmann factor are computed and it is proven that at low temperatures it converges to a certain Gaussian distribution uniformly in all fluctuations of dual variables. This result enables us to define the semiclassical limit of the dual formulation and to determine an analog of the vortex–spin-wave representation for the partition function. Such representation is used to extract leading perturbative contribution to the correlation function which shows power-like decay at weak coupling. Furthermore, we calculate a continuum limit of the dual action, solve classical equations of motion and develop a perturbation theory around nontrivial solutions.