QUARK MATTER 2015
Sep. 27 – Oct. 3, 2015 Kobe, Japan

Contribution ID: **748** Type: **Poster**

# Entanglement Entropy of Several Bosonic Quantum Field Theories

*Tuesday 29 September 2015 16:30 (2 hours)*

We investigate how entanglement entropy behaves in general non-conformal quantum field theories which describe kinds of physical systems. The scalar field in $O(N)$ $\sigma-$model and non-Abelian $SU(N)$ gauge field on lattice are concerned as two typical bosonic models in our study. By virtue of divergency structure of entanglement entropy, we distinguish different phases of $O(N)$ $\sigma-$model, symmetric phase with positive mass square and symmetry-breaking phase with negative one. The ultra-violet divergences in entanglement entropy of field theories, further more, are demonstrated to be cancelled by counter-terms induced on the interface between two subregions entangling to each other. It is consistent with that topological entanglement entropy as non-divergent part of entanglement entropy is renormalizable quantity which is understood as cosmological constant living on interface. In non-Abelian $SU(N)$ gauge field theories, at the same time, interface cosmological constant becomes more important because it is able to clarify ambiguity emerging from different choices of boundary conditions on the interface in gauge field theories simultaneously. In order to extract physical quantity from the disputed issue, we continue to calculate finite temperature dependence, susceptivity to size of subsystem and mutual information which are related to physical parts of entanglement and as well irrelevant to interface counter-terms.

(Based on arXiv: 1411.2916, arXiv: 1503.01766 and a prepared paper.)

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**Session Classification:** Poster Session

**Track Classification:** QCD at High Temperature