July 20, 2020 at 12:00pm

Speaker: Mithat Unsal

Title: Strongly coupled QFT dynamics via TQFT coupling

Abstract: We consider a class of quantum field theories and quantum mechanics, which we couple to topological QFTs, in order to classify non-perturbative effects in the original theory. The TQFT structure arises naturally from turning on a classical background field for a discrete global symmetry.
In SU(N) Yang-Mills theory coupled to $\mathbb Z_N$ TQFT, the non-perturbative expansion parameter is $\exp[-S_I/N]= \exp[-{8 \pi^2}/{g^2N}]$ both in the semi-classical weak coupling domain and strong coupling domain, corresponding to a fractional topological charge and action configurations.
To classify the non-perturbative effects in original SU(N) theory, we must use PSU(N) bundle and lift configurations (critical points at infinity) for which there is no obstruction back to SU(N). These provide a refinement of instanton sums: integer topological charge, but crucially fractional action configurations contribute, providing a TQFT protected generalization of resurgent semiclassical expansion to strong coupling. Monopole-instantons (or fractional instantons) on $T^3 \times S^1_L$ can be interpreted as tunneling events in the 't Hooft flux background in the $PSU(N)$ bundle. The construction provides a new perspective to the strong coupling regime of QFTs and resolves a number of old standing issues, especially, fixes the conflicts between the large-N and instanton analysis.