Claudio Castelnovo (Royal Halloway University of London, UK)

Topological Order and Glassiness

Albeit they are intrinsically different phenomena, certain aspects of topological order and glassiness exhibit intriguing similarities. For instance, if we take the view of a glassy energy landscape where phase space is broken down into statistically similar basins separated by large energy barriers, one could then view topologically ordered states as a realisation of the ultimate glassy system, where the basins are in fact statistically \emph{identical} to any local measurement. In this talk we shall explore some of these points of contact between the two areas of research. We show how exactly solvable models for topological order can inspire new models of quantum glasses where physical quantum relaxation processes (namely, finite-range tunnelling) at low temperature incur a dynamical arrest with diverging time scales displaying either strong or fragile glass behaviour. We also investigate the direct interplay of topological order and conventional (Edwards-Anderson) glassiness by introducing random fields in Kitaev's toric code. We argue that novel quantum phases appear where topological order coexists with spin glassiness.