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Three Dimensional IR N-ality with Eight Supercharges

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I will introduce a new family of IR dualities for quiver gauge theories in three space-time dimensions with eight supercharges. In contrast to the well-known example of 3d mirror symmetry, the aforementioned dualities map Coulomb branches to Coulomb branches and Higgs branches to Higgs branches in the deep IR. A novel feature of these dualities is that the Coulomb branch global symmetry is emergent in the IR on one side of the duality while being manifest in the UV on the other. For a large class of 3d quiver gauge theories, a sequence of these dualities can be explicitly constructed by step-wise implementing a set of four quiver mutations with non-trivial closure relations. A given duality sequence yields a set of quiver gauge theories which flow to the same IR SCFT – a phenomenon I will refer to as IR N-ality. This set of N-al theories always contains a subset of quivers from which the rank of the IR Coulomb branch symmetry can be read off. I will illustrate the construction of the duality sequence and the resultant IR N-ality with a concrete example. Next, I will briefly discuss how IR N-ality proves to be an extremely useful tool for studying the Higgs branches of four/five dimensional SCFTs, focusing on the subclass of theories which are geometrically engineered by compactifying Type IIB/M-theory on three-fold canonical isolated hypersurface singularities. In the concluding section of my talk, I will discuss possible ways in which machine learning/deep learning methods can be deployed to explore such dualities in the landscape of 3d quivers with eight supercharges.

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