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Decoding IR Dualities and Phases with Quad-CFTs in N=1 SU(N) Gauge Theories

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In this talk, I will discuss about our work on understanding the infrared (IR) dynamics of four-dimensional N=1 SU(N) chiral gauge theories with antisymmetric or symmetric rank-2 tensor matter. While Seiberg duality has been instrumental in constructing dual descriptions for theories with fundamental and anti-fundamental matter a systematic duality framework is lacking for tensorial theories. Standard deconfinement methods for these theories often yield dual descriptions that suffer from negative R charges or accidental symmetries, complicating reliable duality checks.Motivated by NS5–D5 brane configurations in string theory, I propose that strongly coupled superconformal theories known as quad-CFTs naturally serve as consistent candidate dual descriptions. For antisymmetric tensor theories, consistent dual descriptions emerge from quad-Sp theories via partial flipping and gauging flavor symmetries. Inspired by this success, I conjecture new dual descriptions for symmetric tensor theories using quad-SO theories, again applying partial flipping and gauging. Intrinsic features of these quad-CFTs—including their mesonic and baryonic branches, moduli spaces, and deformations—directly reproduce and clarify essential physical properties of the original SU(N) theories. These correspondences provide nontrivial consistency checks of the conjectured dualities, and demonstrate that quad-CFTs constitute a robust framework for constructing dual descriptions and systematically studying the IR behavior of N=1 tensorial gauge theories.

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