A tale of two transitions

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In this talk we shall discuss two examples of quantum phase transitions. The first of them involves Rydberg ladders where we show the presence of an emergent Ising transition stabilized via an order-by-disorder mechanism. We identify the competing terms responsible for the transition and estimate a critical coupling strength which agrees well with exact-diagonalization (ED) based numerical studies on finite ladders. The second one involves a constrained bosonic model with subsystem symmetries on an array of square plaquettes. We show that the model exhibits two phases; one with a gapped ground state and the other with a gapless Z2 symmetry-broken ground state. These two ground states are separated by a quantum critical point which exhibits an additional emergent Z2 symmetry and thus belongs to the Ashin-Teller universality class. We find the corresponding critical exponents using ED on finite-sized arrays, provide a phenomenological Landau-Ginzburg theory which identifies the additional emergent symmetry at the critical point, and discuss the role of subsystem symmetries in shaping the nature of the gapless phase and the critical point.