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From SUSY gauge theories to generalized cohomology to Bethe ansatz

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Supersymmetric ground states and supersymmetric boundary conditions in gauge theories with four supercharges are related to equivariant cohomology theories of their spaces of vacua. When we focus on 3d theories compactified on the elliptic curve, the relevant cohomology theory is elliptic, and upon degenerations to 2d and 1d it reduces to K-theory and de Rham cohomology. Via this connection, certain geometric constructions of stable envelopes due to Okounkov and collaborators receive interpretations as supersymmetric interfaces in gauge theories. The linear actions of infinite-dimensional Hopf algebras (Yangians, quantum loop, and elliptic) on the cohomology, constructed via stable envelopes in the literature, are interpreted as actions on the ground states of families of quantum field theories. Some of the generators are realized as interfaces between different QFTs in a family. These structures underlie what is known as the Bethe/Gauge correspondence of Nekrasov-Shatashvili, in which the space of supersymmetric ground states of a family of QFTs is identified with the Hilbert space of a certain integrable model. I will review some of the developments in this area.

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