Integrability, Scattering Amplitudes and the Breaking of Yangian Invariance

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We will discuss the connections between Yangian invariance and integrable spin chains. It will then be explained how to systematically construct Yangian invariants for general symmetry algebras using the quantum inverse scattering method in terms of Grassmannian contour integrals. This leads to highly non-trivial integrations that are related to matrix models and Feynman loop integrals. Finally we will specialize to the D=4 conformal group and the N=4 superconformal group and discuss relations to the scattering amplitudes of N=4 Super Yang-Mills theory. Our results suggest a subtle breaking of Yangian invariance for the latter, with curious implications for their construction from integrability.