GEOMETRY OF INTEGRABLE SYSTEMS

FROM TOPOLOGICAL LAX SYSTEMS TO CONFORMAL FIELD THEORIES

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PhD thesis under the supervision of Bertrand Eynard

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Abstract

This PhD thesis is about a framework in complex geometry and methods thereof for solving sets of compatible differential equations arising from integrable systems, classical or quantum, in the context of the geometry of moduli spaces of connections over complex curves, or Riemann surfaces. It is based on the idea in mathematical Physics that integrable systems possess symmetries that impose algebro-differential constraints, so-called loop equations, on the objects of interest (e.g. partition or correlation functions). In turn, we intend to solve these constraints recursively in certain topological regimes using a particular procedure called the topological recursion. Their solutions are in general generating functions of enumerative-geometric quantities. Since they are for the most part determined by the initial data of the recursive process, it realizes in the making an algebro-geometric classification of the family of integrable models under consideration.