

# GAUDIN MODELS WITH IRREGULAR SINGULARITIES

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This is joint work with B. Feigin and E. Frenkel [2].

The Casimir connection of a complex, semi-simple Lie algebra  $\mathfrak{g}$  with Cartan subalgebra  $\mathfrak{h}$  is a flat connection on  $\mathfrak{h}$  with logarithmic singularities on the root hyperplanes and values in any  $\mathfrak{g}$ -module  $V$  [3, 4]. It yields a family of commuting quantum Hamiltonians acting on the weight spaces of  $V$ . These are expected to have simple spectrum on finite-dimensional  $\mathfrak{g}$ -modules and should therefore give rise to canonical weight basis of irreducible  $\mathfrak{g}$ -modules.

I will explain how to diagonalise these Hamiltonians by using the affine Kac-Moody algebra  $\widehat{\mathfrak{g}}$  at critical level. This mirrors the construction of Feigin-Frenkel-Reshetikhin who diagonalised the Gaudin Hamiltonians arising from the Knizhnik-Zamolodchikov connection [1], and leads to a new class of quantum integrable systems generalising the Gaudin model.

Two interesting, and intimately related new features appear in the construction: the use of non-highest weight representations of affine Lie algebras and differential equations (more precisely Opers) with irregular singularities on the Riemann sphere. The latter describe the spectrum of the algebras of quantum Hamiltonians.

## REFERENCES

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