



Istituto Nazionale di Fisica Nucleare

Bologna Workshop on:

## CFT AND INTEGRABLE MODELS

and their applications from gauge/gravity dualities to statistical mechanics and quantum information



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## Fast QSC Solver for Excited States

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Spectrum of planar  $N=4$  super Yang-Mills theory (SYM) is known to be exactly solvable from integrability, in principle. In practice, only a handful of states were solved non-perturbatively. We introduce a new integrability-based numerical tool called the Fast Quantum Spectral Curve (QSC) Solver, and using it, we solve the spectral problem for  $N = 4$  SYM fully, systematically, efficiently and exactly. Our implementation allows to

1. find the spectrum for a wide range of t'Hooft coupling
2. initialise many states at weak coupling using already available perturbative data.

Using the QSC Solver, we were able to follow states from weak to strong coupling. We have computed all states of  $N=4$  SYM with bare dimension  $< 7$ . In addition, we fit spectrum at strong coupling and analyse the outcome of these fits.

Finally, we break degeneracies of states at strong coupling, and this unlocks the possibility to use the recently proposed dispersive sum rules to extract some OPE coefficients at the leading order of the strong coupling expansion.

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