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Quantum Integrability in the ODE/IM Correspondence Approach for New Exact Results in N=2 Supersymmetric Gauge Theories and Black Holes' Observables

Wednesday, 15 June 2022 11:50 (35 minutes)

In this talk I will explain first of all a new connection we found between quantum integrable models and black holes' perturbation theory. To begin with, I will introduce black holes'quasinormal modes (QNMs) and their role in gravitational waves observations, showing in particular how to connect their mathematically precise definition with the integrable model's (IM) structures derived from the ordinary differential equation (ODE) associated to the black hole perturbation, in the approach of the ODE/IM correspondence. More precisely, I will derive the full system of functional and non linear integral equations (Thermodynamic Bethe Ansatz, TBA) typical of quantum integrability and prove that QNMs verify different equivalent exact quantization conditions. As a consequence, it follows a new simple and effective method to numerically compute the quasinormal modes - the TBA - which I will compare with other methods. I will also give a mathematical explanation of the recently found connection between quasinormal modes and N=2 supersymmetric gauge theories, through the further connection we previously found of these to quantum integrable models and which I will also briefly summarize. Moreover, I will swiftly tell how other black holes' observables like the greybody factor (or absorption coefficient, which accounts for Hawking radiation) could be tackled and computed through the same integrability methods. All this I will show for a generalization of extremal Reissner-Nordström (charged) black holes, but in the end I will explain how we think it should be possible to generalize it to many other (General Relativity or String Theory-) types of black holes, branes, fuzzballs, in either asymptotically flat or asymptotically AdS spacetime and thus provide a new effective tool for the study on one hand of supersymmetric gauge theories and on the other hand of gravitational waves and quantum gravity.

Based on:

1 D. Fioravanti, D. Gregori, arXiv:2112.11434 (2021)

2 D. Fioravanti, D. Gregori, arXiv:1908.08030, Phys.Lett.B 804, 135376 (2020)

3 D. Fioravanti, D. Gregori, H. Shu, to appear soon

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