Contribution ID: **206** Type: **not specified**

Theory: On the dynamics of perturbed Black Holes

Tuesday, September 5, 2023 4:30 PM (15 minutes)

Perturbation theory of vacuum spherically symmetric spacetimes is a crucial tool for understanding the dynamics of black hole (BH) perturbations as well as BH scattering phenomena. Since the pioneering work of Regge and Wheeler it is known that the equations for the perturbations can be decoupled in terms of (gauge-invariant) master functions that satisfy $1 + 1$ wave equations. However, while in the literature only few master equations are known, the full landscape of master equations was recently found, clarifying that Einstein equations actually allows for an infinite set of them. Moreover, it turned out that this is a consequence of the presence of an infinite number of symmetries for the dynamics of perturbed non-rotating BHs. Besides, such symmetries can be associated with the infinite hierarchy of Korteweg-de Vries (KdV) equations. As a consequence, there is also an infinite number of conserved quantities, the KdV integrals. After reviewing the landscape of master equations for BH perturbations and how the KdV integrals naturally arise in this context, we show that these integrals fully determine the BH greybody factors. We exploit the fact that the problem of finding the greybody factors in BH scattering using these conserved quantities can be cast as a moment problem, which has been largely studied during the last century in a wide range of mathematical and physical contexts. There are a number of numerical approaches to tackle the moment problem but a natural semi-analytical solution is given in terms of Padé approximants. The results are compared with previous calculations with the WKB approximation. This whole picture is not restricted to applications to scattering by non-rotating BHs. In fact, it can be used to describe a quite wide variety of physical systems, provided they are described by a Schrodinger equation with a bound state-less potential barrier.

Presenter: LENZI, Michele (Institute of Space Sciences (ICE-CSIC, IEEC), Barcelona)

Session Classification: Parallel Sessions