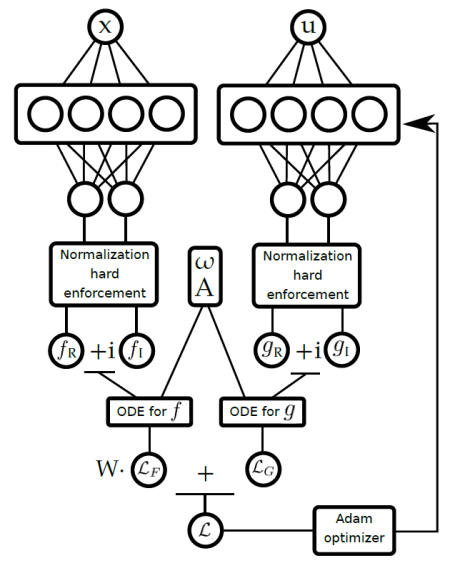
Seminários de Física

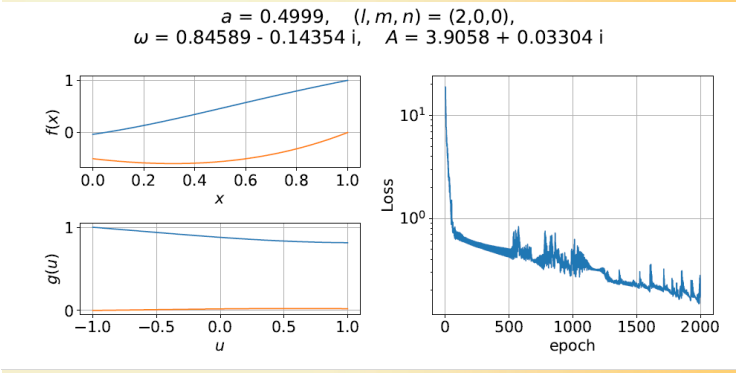
Centro de Física da Universidade do Minho

Segunda-feira, 24 de Abril de 2023, às 14:30h
Auditório da Escola de Ciências, Gualtar

Solving the Teukolsky equation with physics-informed neural networks

Raimon Luna i Perelló, Postdoctoral Researcher, University of Valencia





Resumo: We use physics-informed neural networks (PINNs) to compute the first quasi-normal modes of the Kerr geometry via the Teukolsky equation. This technique allows us to extract the complex frequencies and separation constants of the equation without the need for sophisticated numerical techniques, and with an almost immediate implementation under the PyTorch framework. We are able to compute the oscillation frequencies and damping times for arbitrary black hole spins and masses, with accuracy typically below the percentual level as compared to the accepted values in the literature. We find that PINN-computed quasi-normal modes are indistinguishable from those obtained through existing methods at signal-to-noise ratios (SNRs) larger than 100, making the former reliable for gravitational-wave data analysis in the mid term, before the arrival of third-generation detectors like LISA or the Einstein Telescope, where SNRs of O(1000) might be achieved.