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## The Born regime of gravitational amplitudes

*Friday 11 October 2024 16:55 (20 minutes)*

We study the  $2 \rightarrow 2$  scattering in the regime where the wavelength of the scattered objects is comparable to their distance but is much larger than any Compton wavelength in the quantum field theory. We observe that in this regime - which differs from the eikonal - the Feynman diagram expansion takes the form of a geometric series, akin to the Born series of quantum mechanics. Conversely, we can define the Feynman diagram expansion as the Born series of a relativistic effective-one-body (EOB) Schrödinger equation. For a gravitational theory in this regime we observe that the EOB Schrödinger equation reduces to the Regge-Wheeler or Teukolsky wave equations. We make use of this understanding to study the tree-level Compton scattering off a Kerr black hole. We compute the scalar and photon Compton amplitude up to  $\mathcal{O}(\alpha^3)$  in the black hole spin  $a$  and propose an all-order expression. Remarkably, we find that boundary terms, which are typically neglected, give non-zero contact pieces necessary for restoring crossing symmetry and gauge invariance of the Kerr-Compton amplitude.

### Which topic best fits your talk?

High Energy Physics and Cosmology

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