

Schwarzschild-Tangherlini metric from scattering amplitudes in various dimensions

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We derive the static Schwarzschild-Tangherlini metric by extracting the classical contributions from the multi-loop vertex functions of a graviton emitted from a massive scalar field. At each loop order the classical contribution is proportional to a unique master integral given by the massless sunset integral. By computing the scattering amplitudes up to three-loop order in general dimension, we explicitly derive the expansion of the metric up to the fourth post-Minkowskian order $O(GN^4)$ in four, five and six dimensions. There are ultraviolet divergences that are cancelled with the introduction of higher-derivative nonminimal couplings. The standard Schwarzschild-Tangherlini is recovered by absorbing their effects by an appropriate coordinate transformation induced from the de Donder gauge condition.

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