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## Classical gravitational scattering from a gauge-invariant double copy

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The Gravity effects play an important role both in the black hole scattering and early universe inflation. On the other hand, extremely heavy dynamic systems, e.x. The black hole and early universe, provide a natural environment for detecting classical and quantum gravitational effects. In this talk, we majorly focus on the theoretical part of the gravity effects. We propose a systematic framework to obtain the classical and quantum gravity effect on the two-body scattering bending angle. The framework is based on the heavy-mass effective field theory approach to general relativity. The amplitudes in this effective field theory are constructed using a recently proposed novel color-kinematic/double copy duality, where the duality numerators are gauge invariant and local concerning the massless gravitons. We provide the explicit result on two body bending angles to the third post-Minkowskian order for the classical part and the one-loop order for the quantum part.

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