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Implicit Regularization in a QCD decay of the Higgs boson

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Implicit Regularization (IReg) is a regularization scheme that works in the physical dimension of the theory and allows for the separation of the ultraviolet (UV) and infrared (IR) divergences of an amplitude. We compute the Higgs decay into gluons using an effective Higgs–Yang-Mills interaction in the limit of infinite top quark mass by using a dimension five operator. The decay rate for H⟶gg(g) is calculated in this strictly 4-dimensional set-up to α_sˆ3 order in the strong coupling. We use
spinor-helicity formalism to include the processes that contribute at the same perturbative order in the real emission channels consisting of 3 gluons and a gluon and quark-antiquark final states with light (zero mass) quarks. Unambiguous identification and separation of UV from IR divergences is achieved putting at work the renormalization group scale relation inherent to the method. UV singularities are removed by renormalization and the IR divergences are cancelled due to the method's compliance with the Kinoshita-Lee-Nauenberg (KLN) theorem. The remaining finite integral contributions are evaluated using Package-X. We verify that no evanescent fields such as scalars need be introduced as required by some mixed regularizations that operate partially in the physical dimension.

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