Contribution ID: **29** Type: **not specified**

Soft photon theorem in QCD with massless quarks

Saturday, 16 December 2023 15:30 (15 minutes)

Working to all orders in dimensionally-regularized QCD, we study the radiation of a photon whose energy is much lower than that of external partons, but much larger than the masses of some quarks. We argue that the conventional soft photon theorem receives corrections at leading power in the photon energy, associated with soft virtual loops of massless fermions. These additive corrections give an overall factor times the non-radiative amplitude that is infrared finite and real to all orders in α_s. Based on recent calculations of the three-loop soft gluon current, we identify the lowest-order three-loop correction.

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Session Classification: Parallel 3