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## Transverse Momentum Distributions of Heavy Hadrons and Polarized Heavy Quarks

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We initiate the study of transverse momentum-dependent fragmentation functions (TMD FFs) for heavy quarks fragmenting into heavy hadrons, and calculate all TMD parton distribution functions (PDFs) for the production of polarized heavy quarks from gluons within nucleons. We analyze the rich hierarchies of scales involved in heavy-quark TMD FFs by matching massive SCET onto novel nonperturbative matrix elements in boosted HQET (bHQET). We in particular identify the bHQET matrix elements characterizing the so-called Collins function, which encodes the fragmentation of transversely polarized (heavy) quarks. Another new ingredient of our analysis is the perturbative unpolarized TMD FF for heavy quarks, which we expect to also appear in other observables like flavor-tagged energy-energy correlators in the back-to-back limit. To connect our EFT analysis with phenomenology at the future EIC, we calculate all leading-order matching coefficients of polarized heavy-quark TMD PDFs onto collinear gluon PDFs. We find a nonzero transition rate from longitudinally polarized gluons to transversely polarized heavy quarks, which offers a promising probe of the heavy-quark Collins function in semi-inclusive DIS at the future EIC.

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