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Searching for pseudo-Nambu-Goldstone boson dark matter production in association with top quarks

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Pseudo-Nambu-Goldstone bosons (pNGBs) are attractive dark matter (DM) candidates since they are coupled to the Standard Model (SM) predominantly through derivative interactions. Thereby, they naturally evade the strong existing limits inferred from DM direct detection experiments. Working in an effective field theory that includes both derivative and non-derivative DM-SM operators, we perform a detailed phenomenological study of the Large Hadron Collider reach for pNGB DM production in association with top quarks. Drawing on motivated benchmark scenarios as examples, we compare our results to other collider limits as well as the constraints imposed by DM (in)direct detection experiments and the relic abundance. Furthermore, we explore implications on the viable parameter space of pNGB DM. In particular, we demonstrate that the sensitivity of DM direct detection experiments can be achieved via loop-induced interactions. The search strategies we discuss can serve as a starting point for dedicated experimental analyses by the ATLAS and CMS collaborations.

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Authors: POLESELLO, Giacomo (INFN, Sezione di Pavia (IT)); SCHULTE, Stefan (Max Planck Institute for Physics (Munich)); HAISCH, Ulrich (Max Planck Institute for Physics (Munich))

Presenter: SCHULTE, Stefan (Max Planck Institute for Physics (Munich))

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