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Axion dark matter from heavy quarks

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We propose simple scenarios in which the observed dark matter abundance arises from the decays and scatterings of heavy quarks via the freeze-in production of an axion-like particle with mass in the 10 keV–1 MeV range. These models can be tested by future X-ray telescopes, and in some cases will be almost entirely probed by searches for the two-body decay $K \to \pi + \text{invis}$ at NA62. As a byproduct, we discuss the cancellation of IR divergences in flavor-violating scattering processes relevant for thermal axion production, and we derive the general contribution to axion–photon couplings from all three light quarks.

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