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T-dependence of the axion mass when the $U_A(1)$ and chiral symmetry breaking are tied

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Up to the scale of the spontaneous breaking of Peccei-Quinn symmetry, the axion mass M_a is determined by the QCD topological susceptibility $\chi(T)$ at all temperatures T . Using an approach tying the $U_A(1)$ and chiral symmetry breaking, we calculate $\chi(T)$ for an effective Dyson-Schwinger model of nonperturbative QCD and obtain a good agreement with lattice results for $\chi(T)$, and thus also for $M_a(T)$, for T as high as twice the chiral restoration temperature. The axion mass follows the dictate of the QCD topological susceptibility from vanishing T over the chiral phase transition to high T where the chiral and $U_A(1)$ symmetries are restored. Our prediction is additionally supported by the fact that our topological susceptibility yields the T -dependence of the $U_A(1)$ anomaly-influenced masses of η' and η mesons which is consistent with experimental evidence.

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