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Sphaleron Rate from Lattice Gauge Theory

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The “Sphaleron Rate” (imaginary linear-in-frequency part of the topological density retarded Green’s function) determines the real-time relaxation rate of axial quark number for light quarks in a hot medium, and is relevant in heavy-ion collisions and electroweak baryogenesis. We recently showed how it can be determined in pure-gluon QCD via standard Euclidean simulations, via a novel saddlepoint method.

We extend this work to find the sphaleron rate for (2+1)-flavor QCD with $N_\tau = 8 - 16$ and HISQ action at almost physical pion masses in the temperature range $0.2 - 3$ GeV or $1.2 - 18$ times the crossover temperature T_{pc} . Similar to the pure gauge case, the QCD result is well described across the range of $1.6 - 8$ times T_{pc} as $\Gamma_s \simeq 20(\alpha_s T)^4$, where α_s is the MSbar coupling at $\bar{\mu} = 2\pi T$, determined using the gradient-flow technique.

Topical area

QCD at Non-zero Temperature

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