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Thermal evolution of quark stars from perturbative QCD

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Since Witten's proposal that symmetric deconfined u, d, and s quark matter might be the true absolute ground state, properties of quark stars have been extensively studied. By choosing an equation of state to describe the matter inside these stars, it is possible to solve the Tolman-Oppenheimer-Volkoff equations to obtain the mass and radius of the star. However, it has become clear that measuring solely the mass and radius will not be sufficient to distinguish between neutron stars, hybrid stars and quark stars. Therefore, it is necessary to take into account other observables that are closely related to microscopic physics.

One possibility is the thermal evolution of these stars. The general relativistic equations of energy balance and energy transport that are solved in a numerical cooling simulation involve both microscopic (neutrino emissivity, heat capacity, thermal conductivity) and macroscopic (metric function, mass, radius) quantities.

In this work, we study the structure and thermal evolution of quark stars employing equations of state from perturbative QCD. We build the framework for acquiring cooling solutions and discuss the consequences arising from the application of different equations of state to describe the properties of quark matter. Additionally, we examine the properties of a thin nuclear crust in quark stars and investigate its impact on the cooling process, comparing our results with available observational data.

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