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On the role of fluctuations in compact objects

One of the pending challenges of modern physics is to probe the microscopic equation of state (EoS) of cold and dense matter to constraint macroscopic neutron star observations such as the masses and radii. Still, unanswered issues concern the detailed composition of matter in the core of neutron stars at high pressure or the possible presence of strange quarks or hyperons in neutron stars (hyperon puzzle).

Different matter phases with accompanying transitions are most likely to appear whose details, particularly in the vicinity of their criticality, are triggered by quantum and thermal fluctuations. In this talk, a non-perturbative functional renormalization group approach is employed in order to investigate the influence of quantum and thermal fluctuations on the EoS for beta stable quark matter. The findings are confronted to results obtained with common mean-field approximations where usually important fluctuations are ignored.

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