Contribution ID: **84** Type: **not specified**

QCD axion couplings in dense matter and astrophysical bounds

Wednesday 25 September 2024 14:15 (15 minutes)

As an elegant solution to the strong CP problem and promising dark matter candidate, the QCD axion is one of the best motivated particles beyond the SM. The hunt for the QCD axion, both with terrestrial experiments as well as astrophysical observables, has exploded in the last years. As of today, astrophysical observations, such as neutron star cooling and energy loss from supernovae, place the strongest bounds.
In this talk, I will show that astrophysical bounds depend on a non-trivial momentum dependence of the axion-nucleon coupling in zero- as well as in finite density environments. This dependence is induced by one-loop corrections to the coupling that can be systematically calculated within the framework of chiral perturbation theory, both at zero density and in thermal field theory. As a consequence, the supernova bound is strengthened and the momentum dependence further allows us to constrain large parts of parameter space of the axion neutron coupling.
Additionally, I will talk about the model independent axion production mechanism in supernova, leading to a orders of magnitude stricter bound than in current literature, where the operator responsible for the dominant model independent contribution has been neglected so far.

Primary authors: Mr WEILER, Andreas (TUM); Mr SPRINGMANN, Konstantin (Weizmann Institute); STADLBAUER, Michael (MPP/TUM); Mr STELZL, Stefan (EPFL)

Presenter: STADLBAUER, Michael (MPP/TUM)

Session Classification: Parallel Wednesday Pheno 2

Track Classification: Particle Phenomenology