Contribution ID: **15** Type: **not specified**

Spontaneous Peccei-Quinn symmetry breaking renders sterile neutrino, axion and χboson to be candidates for dark matter particles

Wednesday, 18 May 2022 15:00 (15 minutes)

We study the Peccei-Quinn (PQ) symmetry of the sterile right-handed neutrino sector and the gauge symmetries of the Standard Model. Due to four-fermion interactions, spontaneous breaking of these symmetries at the electroweak scale generates top-quark Dirac mass and sterile-neutrino Majorana mass. The top quark channels yield massive Higgs, $W^{\pm}$ and Z^0 bosons. The sterile neutrino channel yields the heaviest sterile neutrino Majorana mass, sterile Nambu-Goldstone axion (or majoron) and massive scalar χboson. Four-fermion operators effectively induce their tiny couplings to SM particles. We show that a sterile QCD axion is the PQ solution to the strong CP problem. The lightest and heaviest sterile neutrinos ($m_N^e \sim 10^2$ keV and $m_N^\tau \sim 10^2$ GeV), a sterile QCD axion ($m_a < 10^{-8}$ eV, $g_{a\gamma} < 10^{-13}\text{GeV}^{-1}$) and a Higgs-like χboson ($m_\chi \sim 10^2$ GeV) can be dark matter particle candidates, for the constraints of their tiny couplings and long lifetimes inferred from the W-boson decay width, Xenon1T and precision fine-structure-constant experiments. The axion and χboson couplings to SM particles are
below the values reached by current laboratory experiments and astrophysical observations for directly or indirectly detecting dark matter particles.

Primary author: Prof. XUE, She-Sheng (ICRANet, Physics Department, Sapienza University of Rome)

Presenter: Prof. XUE, She-Sheng (ICRANet, Physics Department, Sapienza University of Rome)

Session Classification: Afternoon session