

Axion Quality from Superconformal Dynamics

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We discuss a possibility that a superconformal dynamics induces the emergence of a global $U(1)_{PQ}$ symmetry to solve the strong CP problem through the axion. Fields spontaneously breaking the $U(1)_{PQ}$ symmetry couple to new quarks charged under the ordinary color $SU(3)_C$ and a new $SU(N)$ gauge group. The theory flows into an IR fixed point where the $U(1)_{PQ}$ breaking fields hold a large anomalous dimension leading to the suppression of $U(1)_{PQ}$ -violating higher dimensional operators. The spontaneous breaking of the $U(1)_{PQ}$ makes the new quarks massive. The $U(1)_{PQ}$ symmetry is anomalous under the $SU(3)_C$ but not under the $SU(N)$ so that the axion couples to only the color $SU(3)_C$ and the usual axion potential is generated. We also comment on a model that the $U(1)_{PQ}$ breaking fields are realized as meson superfields in a new supersymmetric QCD.

Primary author: Prof. NAKAI, Yuichiro (T. D. Lee Institute, Shanghai)

Presenter: Prof. NAKAI, Yuichiro (T. D. Lee Institute, Shanghai)

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