

Solving the Strong CP Problem with Heavy Axions

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We propose a general framework that extends the Standard Model (SM) to the gauge group $SU(2k+3) \times Sp(2k)' \times U(1)'_Y \times Z_4$. The SM quarks are embedded in the fundamental multiplet of $SU(2k+3)$, $Sp(2k)'$ provides an extra technicolor (TC) sector, $U(1)'_Y$ helps reproduce the correct SM hypercharges, and, the discrete Z_4 forbids unwanted TC fermion mass terms. The strong CP problem is solved by two axions associated with the two non-Abelian groups. Both axions can be made heavy by the combined effects of small instantons and TC confinement. We scan the viable parameter space for different values of k and present the resulting axion spectrum. The predicted masses lie well above the conventional QCD-axion window and open a richer set of phenomenological signatures for experimental searches.

Primary author(s) : JIANG, Xu-Hui (ICTP-AP); MA, Teng (ICTP-AP); DIRISI, Vigilante (ICTP-AP, University of Chinese Academy of Science); Ms LIN, Dan (ICTP-AP); Prof. CACCIAPAGLIA, Giacomo (LPTHE)

Presenter(s) : JIANG, Xu-Hui (ICTP-AP)

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