

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

2A & 2B, Raja S.C. Mullick Road, Jadavpur, Kolkata-700032, India

Seminar Notice

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School of Physical Sciences

Title:	Gravity safe, electroweak natural axionic solution to strong CP and SUSY μ problems in the LHC era with determination of the PQ scale
Speaker:	Dibyashree Sengupta, Department of Physics and Astronomy, University of Oklahoma, USA
Date:	July 16, 2019 (Tuesday)
Time:	3:00 p.m.
Venue:	Physics Seminar Room (C-406), 3rd Floor, Centenary Building, IACS
Abstract:	Particle physics models with Peccei-Quinn (PQ) symmetry breaking as a consequence of supersymmetry (SUSY) breaking are attractive in that they solve the strong CP problem with a SUSY DFSZ-like axion, link the SUSY breaking and PQ breaking intermediate mass scales and can resolve the SUSY μ problem with a naturalness-required weak scale μ term whilst soft SUSY breaking terms inhabit the multi-TeV regime as required by LHC sparticle mass limits and the Higgs mass measurement. In spite of so many advantages these models have a major disadvantage in that global symmetries are incompatible with gravity and hence suffer a generic gravity spoliation problem. We present two models based on the discrete R-symmetry Z_{24}^R which may emerge from compactification of 10-d Lorentzian spacetime in string theory where the μ term and dangerous proton decay and R-parity violating operators are either suppressed or forbidden while a gravity-safe PQ symmetry emerges as an accidental approximate global symmetry leading to a solution to the strong CP problem and a weak-scale/natural value for the μ term. Though there are many other solutions to the μ problem, the models based on discrete R-symmetry Z_{24}^R seem highly motivated. A general consideration of string theory landscape imply a mild statistical draw towards large soft SUSY breaking terms. We can extend this reasoning to the models considered here in which PQ symmetry is broken by a large negative quartic soft term. The pull towards large soft terms also pulls the PQ scale as large as possible. Unless this is tempered by rather severe (unknown) cosmological or anthropic bounds on the density of dark matter, then we would expect a far greater abundance of dark matter than is observed. This conclusion cannot be negated by adopting a tiny axion misalignment angle θ_i because WIMPs are also overproduced at large f_a. Hence, we conclude that setting the PQ scale via anthropics is highly unlikely. Instead, requiring soft SUSY breaking terms of order the gravity-mediation scale $m_{3/2} \sim 10$-100 TeV places the mixed axion-neutralino dark matter abundance into the intermediate scale sweet zone where $f_a \sim 10^{11}$-10^{12} GeV. We compare our analysis to the more general case of a generic SUSY DFSZ axion model with uniform selection on θ_i but leading to the measured dark matter abundance: this approach leads to a preference for $f_a \sim 10^{12}$ GeV.

All are cordially invited to attend the seminar