

SUSY status in light of LHC and WIMP search experiments

Friday, 12 July 2024 09:30 (30 minutes)

There is rampant pessimism in the collider and dark matter communities regarding the prospects for SUSY dark matter, but this is based on old prejudices from the 20th century. A proper calculation of electroweak finetuning reveals the LSP should be a light higgsino state which is thermally underproduced. But solving the strong CP problem requires a QCD axion, and the DFSZ model which requires two Higgs doublets melds well with SUSY. In fact, SUSY and axions solve several problems on each side: for instance, intrinsically SUSY discrete R-symmetries which arise from string compactifications yield R-parity conservation and allow PQ to emerge as an accidental, approximate global U(1) while solving the SUSY mu problem where the PQ scale f_a is then related to the hidden sector SUSY breaking scale $\sim 10^{11}$ GeV, in the cosmological sweet spot. Dark matter is then a mixture of DFSZ axions and higgsino-like WIMPs, the latter with a diminished abundance: mainly axions. The axion-photon coupling is quite diminished due to the presence of higgsinos. The relic abundance requires eight-coupled Boltzmann equations which account also for saxions and axinos in the early universe. The effect of light stringy moduli (LSM) fields is also addressed, and seems to require $m(\text{LSM}) > \sim 5$ PeV to avoid overproduction of higgsino-like WIMPs.

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Session Classification: Plenary