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PQ Symmetric Pure Gravity Mediation

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Successful models of Pure Gravity Mediation (PGM) with radiative electroweak symmetry breaking can be expressed with as few as two free parameters which can be taken as the gravitino mass and tan β. These models easily support a 125-126 GeV Higgs mass at the expense of a scalar spectrum in the multi-TeV range and a much lighter wino as the lightest supersymmetric particle. In these models, it is also quite generic that the Higgs mixing mass parameter, μ, which is determined by the minimization of the Higgs potential is also in the multi-TeV range. For μ > 0, the thermal relic density of winos is too small to account for the dark matter. The same is true for μ < 0 unless the gravitino mass is of order 500 TeV. Here, we consider the origin of a multi-TeV μ parameter arising from the breakdown of a Peccei-Quinn (PQ) symmetry. A coupling of the PQ-symmetry breaking field, P , to the MSSM Higgs doublets, naturally leads to a value of μ ~ Pˆ2 /MP ~ O(100) TeV and of order that is required in PGM models. In this case, axions make up the dark matter or some fraction of the dark matter with the remainder made up from thermal or non-thermal winos. We also provide solutions to the problem of isocurvature fluctuations with axion dark matter in this context.

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