Bi-maximal mixing and bilinear $R$ violation

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Abstract

We perform a general analytic study of feasibility of obtaining a combined explanation for the deficits in the solar and the atmospheric neutrino fluxes with two large mixing angles in supersymmetric model with bilinear $R$ parity violations. The required hierarchy among the solar and atmospheric neutrino mass scales follows in this framework in the presence of an approximate Higgs–slepton universality at the weak scale. The solar mixing angle is shown to be related to non-universality in slepton mass terms specifically to differences in soft parameters of the first two leptonic generations. It is shown that this flavour universality violation should be as strong as the Higgs–slepton universality violation if solar neutrino mixing angle is to be large. The standard supergravity models with universal boundary conditions at a high scale lead to the required Higgs–slepton universality violations but the predicted violation of flavour universality among the first two generations is much smaller than required. This model therefore cannot provide an explanation of large solar neutrino mixing angle unless some universality violations in soft supersymmetry breaking parameters are introduced at a high scale itself. © 2002 Elsevier Science B.V. All rights reserved.

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1. Introduction

Experimental observations of deficits in the solar [1] and atmospheric [2] neutrino fluxes have provided concrete ground to believe in neutrino oscillations. These experimental results are consistent with a simple picture of three active neutrinos mixing with each other. Within this picture, two independent (mass)$^2$ differences ($\Delta_{\odot}, \Delta_{\text{atm}}$) among three neutrinos govern the oscillations of the solar and atmospheric neutrinos, respectively. One