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QUARK MIXING MODEL WITH S3 MODULAR SYMMETRY AND 3 HIGGS DOUBLETS

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An open problem that the Standard Model does not solve is about the origin of the mass hierarchy among fermions. Different alternatives have been

proposed by adding extra groups to the Gauge group of the Standard Model or by building hybrid models with some of them. It has been shown that the S3 symmetry has given good results if, in addition, three Higgs doublets with their invariant potential of S3 are introduced. However, when taking into account the minimization conditions of the Higgs potential, the resulting matrix VCKM exhibits a residual symmetry with zeros in some entries. Following the success of S3, an extension of the Standard Model is proposed by means of the same

group, but obtained from modular symmetry. In doing so, certain special functions known as modular forms are taken into account, which have a particular

transformation under the application of the modular group. By considering a modular symmetry, it is possible to assign to the quark fields and Higgs fields

a new quantity known as the modular weight which, together with the symmetry of S3, produces new constraints on the way the Yukawa sector Lagrangian

is built and hence the couplings, which will be in terms of modular forms. A proper assignment of the quark and Higgs fields in S3 and their modular weights allows a mass matrix with texture zeros to be written. When calculating the elements of the quark mixing matrix VCKM, it is found that, indeed, the VCKM matrix does not exhibit zeros in any of its inputs and they are comparable to the data provided by the PDG.

Author: Mr CERON, Carlos (UNAM)

Co-author: MONDRAGON, Myriam

Presenter: Mr CERON, Carlos (UNAM)

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