

# Complex $S_3$ Symmetric 3HDM

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We discuss a three-Higgs-doublet model with an underlying  $S_3$  symmetry, allowing in principle for complex couplings. In this framework it is possible to have either spontaneous or explicit CP violation in the scalar sector, depending on the regions of parameter space corresponding to the different possible vacua of the  $S_3$  symmetric potential. We list all possible vacuum structures allowing for CP violation in the scalar sector specifying whether it can be explicit or spontaneous. It is by now established that CP is violated in the flavour sector and that the Cabibbo-Kobayashi-Maskawa matrix is complex. In order to understand what are the possible sources of CP violation in the Yukawa sector we analyse the implications of the different available choices of representations for the quarks under the  $S_3$  group. This classification is based strictly on the exact  $S_3$ -symmetric scalar potential with no soft symmetry breaking terms. The scalar sector of one such model was explored numerically. After applying the theoretical and the most important experimental constraints the available parameter space is shown to be able to give rise to light neutral scalars at the  $O(\text{MeV})$  scale

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