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A 3HDM with possible two dark matter candidates

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Content :

We introduce a 3-Higgs Doublet Model (3HDM) with two Inert (or dark) (pseudo)scalar doublets and an active Higgs one, hence termed I(2+1)HDM, in the presence of a discrete Z_3 acting upon the three doublet fields. Assuming a maximally symmetric configuration of the parameters related to the two dark doublets, we show that such a construct yields a two-component Dark Matter (DM) model and the two DM candidates have opposite CP parity. Herein, the most interesting solutions, those that saturate the relic density and where contributions to the latter from the two DM candidates are of similar magnitude, are achieved when there is a high level of degeneracy in the (dark) charged sector. In order to probe this phenomenology, we have produced a set of benchmark scenarios in the I(2+1)HDM, with the invoked Z_3 symmetry, which are further compliant with (in)direct searches for DM as well as other experimental data impinging on both the dark and Higgs sectors of the model, chiefly, in the form of Electro-Weak Precision Observables (EWPOs), Standard Model (SM)-like Higgs boson measurements at the Large Hadron Collider (LHC) and void searches for additional (pseudo)scalar states at the CERN machine and previous colliders.

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