

# Dark matter in the three Higgs doublet model

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In this talk we discuss the model with three Higgs doublets, focusing on the particular case in which only one doublet acquires an expected vacuum value (VEV), preserving a parity  $Z_N$ . The other two doublets do not develop a VEV and are, therefore, inert. The lightest field of the inert doublets is stable and a proper dark matter (DM) candidate. For the case of a  $Z_2$  symmetry, we discuss the new regions of DM relic density and constrain the model using results from LHC and DM direct and indirect detection experiments, including the interesting case in which we allow a CP-violation phase in the inert sector. As in this model there are two generations of inert fields, there are decays that are not present in the model with a single inert doublet, such as the one-loop induced decay of the next-to-lightest scalar,  $h \rightarrow H_1 H_2 \rightarrow H_1 H_1 f \bar{f}$ , that would lead to a final state with a large missing energy and di-leptons/di-jets. We will also discuss the case of a  $Z_3$  symmetry, wherein the special case of a highly symmetric potential there are two DM candidates. We discuss a parameter space such that the two DM candidates contribute equally to the observed relic density, which corresponds to the case of high degeneration among the charged inert.

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