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Phenomenology of the Dark Matter sector in the Two Higgs Doublet Model with Complex Scalar Singlet extension

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Extensions of the Two Higgs Doublet model with a complex scalar singlet (2HDMS) can accommodate all current experimental constraints and are highly motivated candidates for Beyond Standard Model Physics. It can successfully provide a dark matter candidate as well as explain baryogenesis and provides gravitational wave signals. In this work, we focus on the dark matter phenomenology of the 2HDMS with the complex scalar singlet as the dark matter candidate. We study variations of dark matter observables with respect to the model parameters and present representative benchmark points in the light and heavy dark matter mass regions allowed by existing experimental constraints from dark matter, flavour physics and collider searches. We also compare real and complex scalar dark matter in the context of 2HDMS. Further, we discuss the discovery potential of such scenarios at the HL-LHC and at future e+e− colliders.

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