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Dark Matter and Higgs Bosons in the MSSM

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We investigate dark matter (DM) in the context of the minimal supersymmetric extension of the standard model (MSSM). We scan through the MSSM parameter space and search for solutions that (a) are consistent with the Higgs discovery and other collider searches; (b) satisfy the flavor constraints from B physics; (c) give a DM candidate with the correct thermal relic density; and (d) are allowed by the DM direct detection experiments. For the surviving models with our parameter scan, we find the following features: (1) The DM candidate is largely a Bino-like neutralino with non-zero but less than 20% Wino and Higgsino fractions; (2) Constraints from the Higgs sector and rare b decay measurements exclude the low mass region favored by the DAMA, CoGeNT, and CRESST experiments; (3) The relic density requirement clearly pins down the solutions from the Z and Higgs resonances (Z,h,H,A funnels) and co-annihilations; (4) Future direct search experiments will likely fully cover the Z,h funnel regions, and H,A funnel regions as well except for the "blind spots"; (5) Future indirect search experiments will be more sensitive to the CP-odd Higgs exchange due to its s-wave nature; (6) The branching fraction for the SM-like Higgs decay to DM can be as high as 8%, while those from heavier Higgs decays to neutralinos and charginos can be as high as 20%. We show that collider searches provide valuable information complementary to what may be obtained from direct detections and astroparticle observations, and that the Higgs bosons may play an essential role.

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