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Searching for leptophilic composite asymmetric dark sector at e+e− colliders

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Composite asymmetric dark matter (ADM) models provide a well-motivated paradigm that simultaneously explains dark matter (DM) relic density and matter-antimatter asymmetry. In these models, the mass of the DM candidate (the lightest dark baryon) is generated through the dark confinement scale dynamics. Although the leptophilic composite ADM model offers a viable framework, comprehensive studies of its collider phenomenology are absent. This work systematically explores novel signatures from leptophilic composite asymmetric dark sector at both low-energy and high-energy e^+e^- colliders as well as other existing collider constraints. We demonstrate detectability of TeV-scale mediators along with sub-GeV to GeV-scale lightest dark mesons at Belle II and its proposed far detector, GAZELLE, as well as CEPC experiments. Moreover, these experiments exhibit complementary coverage of the model parameter space.

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