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Z-Portal Dark Pion Dark Matter and Dark Showers

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A dark sector containing a confining non-abelian gauge group with multiple flavors of light dark quarks is expected to have dark pions being the lightest dark hadrons. The lightest dark pion, if stable, can be a dark matter candidate. The heavier dark pions can decay through the Z boson portal to the Standard Model (SM) particles if the light dark quarks mix with heavy electroweak doublets or from the dark Z' -Z mixing. The dark pion relic density is determined by the forbidden channel of light dark pions annihilating to heavier dark pions, or the heavy dark pion decay rate. The decay lengths of the heavy dark pions are typically macroscopic, and hence give distinctive collider signals. The usual direct or indirect searches of dark matter are not effective for this model. The dark showers generated by the Z decays into the dark sector and the FCNC decays of the SM mesons may provide the best probes.

Author: CHENG, Hsin-Chia (University of California, Davis)

Presenter: CHENG, Hsin-Chia (University of California, Davis)

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