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Dark Gamma Ray Bursts

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It is well known that a star can capture dark matter (DM) particles, which condense close to its center and eventually annihilate. In this work, we trace capture, evaporation and annihilation rates throughout the life of a massive star and show that it culminates in an intense annihilation burst coincident with the death of the star in a core collapse supernova. The reason is that, along with the stellar interior, also its DM core heats up and contracts, so that the DM density increases rapidly during the final stages of stellar evolution. We argue that, somewhat counter-intuitively, the annihilation burst is more intense if DM annihilation is a p-wave process than for s-wave annihilation. If among the DM annihilation products are particles like dark photons that can escape the exploding star and decay to Standard Model particles later, the annihilation burst results in a flash of gamma rays accompanying the supernova. For a galactic supernova, this "dark gamma ray burst" may be observable in Fermi-LAT, H.E.S.S. or CTA.

Summary

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