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Nonperturbative Effects in Late Time Dark Matter Phenomenology

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Self-interacting dark matter is a promising candidate for solving the small-scale problems in the standard model of cosmology. A natural consequence of having self-interactions among dark matter particles is the Sommerfeld effect which can affect both the annihilation and self-scattering rates of dark matter particles. I shall show that as a result of the Sommerfeld effect, caused by a long-range off-diagonal interaction, the dark matter annihilation signal from the Milky Way center is preferentially enhanced by several orders of magnitude. This result can have important implication for indirect detection searches. I shall also explain this result with the help of simple particle exchange symmetry. The same interaction also predicts a faster dark matter halo cooling rate and a new drag force induced by large inelastic scattering. It could potentially modify the late time dynamics of the halos.

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