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t-channel singularity in dark matter considerations: the problem and its solution

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If the mediator of a t -channel process is allowed to be on its mass-shell, the matrix element becomes singular, leading to infinite cross section. In the case of a stable, massive mediator neither IR-regularization methods nor decay width can be used to regularize the divergence.

This issue has not been extensively discussed in the existing literature, even though it affects processes that are already present in the Standard Model of particle physics. The natural context of the problem are, however, SM extensions that provide massive, stable dark matter candidates.

In my talk, I will formulate precise conditions for the singularity to occur in a given process and present examples of singular processes both in the SM and beyond it. Then, I will demonstrate a solution, developed within thermal field theory, that allows to calculate mediator's effective width regularizing the divergence.

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