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A numerical approach to Dissipative Self-interacting Dark Matter

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One of the first models for Dark Matter (DM) has historically been the Cold Dark Matter (CDM) Model. This model works well on large scales, however, it breaks on smaller scales. To remedy this, a fix has been proposed in the form of Self-Interacting Dark Matter (SIDM), which can accurately reproduce some of the structure of galaxies. This approach does not fulfil every possible criterion for a DM candidate, which justifies a further extension to the model.

We consider a Dissipative SIDM model as proposed in [1] and calculate both elastic and inelastic scattering cross-sections to improve larger-scale fluid-based simulations (similar to [2]). To make this possible, one has to numerically solve the Schrödinger equation, and extract the scattering amplitudes.

In this talk, we will discuss our solution to the problem, its architecture and some of the caveats we had to work around. Furthermore, we cover validating, debugging and optimising code to make it fast and correct. Finally, there will be a comparison of our solution to existing analytic approximations as well as larger-scale numeric simulations from other papers and give a small outlook to a more general case that could extend this model further.

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