

Executive Summary: A perturbative approach to a nonlinear advection-diffusion equation of particle transport

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What is this contribution about?

This contribution will deal with a nonlinear diffusion-advection equation, representing a self-consistent transport model, that would usually be described by two separate equations, for the particle distribution and the induced waves in the background plasma.

Why is it relevant / interesting?

The interest in particle transport, especially in a nonlinear form, has been of great interest in the recent years, so that our formulation could be a useful tool in the near future, regarding fields like the interstellar medium, supernove remnants and shock acceleration.

What have we done?

We introduced a equation of particle transport, including a nonlinear diffusion term, that we expanded in a nonlinear parameter, resulting in a set of solvable linear equations, that can be solved in a semi analytical way, producing approximate solutions in the process.

What is the result?

We produced a number of approximate solutions for the nonlinear equation, for different sets of parameters, different geometrical symmetries and different kinds of nonlinearity in the diffusion term, highlighting the broad and intuitive applicability of the presented expansion technique.