Similarity properties, critical behaviour and self-similar dynamics of radiating fluids : from dimensional analysis to the Burgan-Feix-Munier transformation

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The self-similar solutions and similarity properties of flows appear as a powerful theoretical tool which allows to validate numerical simulations and identify the key parameters in experiments [1]. Thanks to their analytical tractability as well as their physical content, the self-similar solutions play an important role in order to study the dynamics of physical systems and specifically the dynamics of High-Energy-Density matter [2].

In this work we demonstrate that we can unify apparently disparate and ad hoc methods which allow to obtain these specific class of solutions to differential equations with a unique transformation named the Burgan-Feix-Munier transformation (BFMT) [3,4,5,6]. We present the application of the BFMT on the radiating hydrodynamics regime study in [7,8]. Based on the theoretical results which were obtained, we determine the critical regime which play an important role and can be observed in several High-Energy Density Physics domains as well as in astrophysical situations.

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