Self-similar dynamics of radiative condensation in astrophysical and laboratory optically thin plasmas

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From the galaxy dynamics or the collapse of molecular clouds to Z-pinches experiments [1], the radiative condensation is an important process in different high energy density environments at different spatial and temporal scales. In order to study this phenomenon, we developed through use of the Burgan-Feix-Munier transformation [2] new self-similar solutions which generalize solutions recently obtained [3,4]. We compare them to multi-dimensional numerical simulations obtained with the C-CLAWPACK code [3,5]. Furthermore, the stability study reveals the existence of a new radiating instability, besides the cooling instability. A theoretical criterion was built to predict the emergence of this kind of instabilities. We will discuss the implications of these new results regarding different astrophysical situations. Eventually we will raise the opportunity to reproduce these phenomena with powerful laser facilities.

References
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