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Mathematical Analysis of a Differential Equation Modeling Charged Elements Aggregating in a Relativistic Zero-Magnetic Field

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Abstract: We analyze, in spaces of distributions with finite higher moments, discrete mass and momentum dependent equations describing the movement of charged particles (electrons, ions) aggregating and moving in a relativistic zero-magnetic field. The model is a combination of two processes (kinetic and aggregation), each of which is proven to be separately conservative. Under specific hypothesis, notably on the relativistic work and aggregation rate, we prove existence results for the full model using the perturbation theory and the subordination principle. This result may have a great impact, especially in the full control of the total number of charged particles described by the model.

Keywords: *fractional differential model; magnetic field; perturbation; kinetic processes; subordination principle; aggregation; well-posedness.*

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1 Introduction

It is well known [1] that magnetic fields can be produced by charged particles moving in the space. The particles such as electrons or ions, produce complicated but well known magnetic fields that depend on their charge, and their momentum. There are numerous applications and implications of the effects caused by the movements of charged particles in (zero) magnetic fields. The most common example, in consequence of the recent discoveries in the technology of ultrahigh intensity lasers and high current relativistic

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