

Abstract Submitted
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System-scale simulation based on kinetic theory: the ECsim code

GIOVANNI LAPENTA, JOOST CROONEN, GIUSEPPE ARRO, Katholieke Univ Leuven — We present the ECsim approach [1] to modelling macroscopic systems. The kinetic approach is valid at all scales but it becomes costly to use at large scale. The most common approach to kinetic plasma modelling is the explicit particle in cell method (PIC). This approach requires to resolve all scales, from the smallest electron scale. Failure to do that incurs into rapid and disruptive numerical heating. If one desires to resolve only intermediate or large scales, the explicit PIC cannot be of help. It will still have the burden to need to resolve all electron scales. But what if one is interested in studying the electron motion in ion scale-features without resolving the electro-magnetic fields at electron scales? For this task we use a new energy conserving semi-implicit PIC method [1]. This approach has been used for a number of years in the modelling of reconnection in space plasmas [2]. Here we show two new applications of ECsim: modelling of fusion devices and modelling of the heliosphere from 10 solar radii to beyond the orbit of the Earth. [1] Lapenta, Giovanni. JCP 334 (2017): 349-366. [2] Lapenta, Giovanni, et al. ApJ (2020): 888 (2)

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