Test

Rhys Doyle[1]

[1]Dublin City University

November 13, 2018

Abstract

The scientific community is awash with countless different modelling techniques and literature claiming to present the most effective form of modelling Low-Temperature Plasmas (LTPs). To that end, the objective of this review is to examine the research available in the scientific community relating to the modelling of LTPs, and herein summarise how in which such models are executed. The purpose for the construction of this review is to prepare for a final year project in which the uncertainty in Low-Temperature Plasmas will be investigated. This review will, therefore, compile a condensed version of three of the most commonly used modelling methods, Particle-in-Cell, Global and Surface Interactions, with the objective of creating an overview of the types of models currently in use.

Introduction

In the 1920s Irving Langmuir described a state of matter which he would subsequently name plasma (1). The apparent fourth state of matter was to take the form of an ionized gas with high electrical conductivity. In the case of an ideal plasma, the net charge of a system would be zero like that of an ideal gas, however, this would consist of a so-called soup of positively and negatively charged particles unbound to each other. The charge separation with plasma is what gives way to their conductive properties, through the creation of electric fields. The relatively late discovery of plasmas lends itself to the fact they rarely occur naturally on Earth, with the only common occurrence being lighting.

The evolution of lab-based plasma creation and computational analysis has spurred a generation of professionals set on developing applications for plasmas. One such application is in the field of Thermonuclear Fusion, where the aim is to replicate the fusion process invoked by stars to create a renewable energy source. A crucial element to all plasma research has been computational modelling and subsequently is the subject of this review. To that end, we will explore the methods used in Particle-in-Cell, Global and

5

Surface Interaction models, each of which addresses the modelling of plasmas in different ways.(Tieleman et al., 1997)

References

D P Tieleman, S J Marrink, and H J C Berendsen. A computer perspective of membranes: molecular dynamics studies of lipid bilayer systems. 1331:235–270, 1997. URL http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.820.9444{&}rep=rep1{&}type=pdf.