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DEVELOPMENT OF A SMALL-SCALE, LOW COST, TURN-KEY SOLUTION HELICON PLASMA SOURCE FOR THE ENHANCEMENT OF PLASMA PHYSICS RESEARCH IN DEVELOPING COUNTRIES

Abstract

The scientific method, the cornerstone of any research and development process, undergoes an important step between the formulation of a question and the actual testing and data analysis. Regarding research in plasma physics, extensively used in the development of technologies for space activities and the study of naturally occurring phenomena in space, there is a financial and time gap between these two stages that might prevent the process to unfold efficiently.

The gap consists in the engineering design and implementation processes required to develop experimental laboratories, which in this field is mainly composed of a plasma source, an assortment of measuring devices, and data acquisition hardware and software. In developing countries, it is difficult to overcome this gap, due to the lack of financial resources and know-how knowledge needed to carry out the process. It often limits the scarce amount of researchers to investigate theoretical subjects of plasma physics

It is important, for this type of countries, to encourage plasma physics research as a first step to engage in the various space applications related to it. Some important applications include many types of electrically-powered spacecraft propulsion, and the potential use of magnetohydrodynamics for energy conversion in spacecrafts, among others. Moreover, there are important industrial processes that require the use of plasma in order to manufacture parts used in space applications, including surface processing and high precision machining.

The proposed solution lies in developing a standardized, small scale, low capital and operational cost, turn-key helicon plasma source, with its corresponding measuring devices. The reason for developing this specific type of plasma source is that it produces high density plasmas with lower levels of energy and magnetic field intensity, compared to other plasma sources, which permits the simulations of a wider range of industrial processes and space applications.Moreover, a plan for commercializing the system, optimized to reduce the cost and commissioning time, will further the effectiveness of this solution.

Numerous helicon plasma sources have been developed in research institutions around the world. However, there is no commercial helicon plasma source that is meant to solve the problems mentioned above. The engineering design of the small-scale helicon plasma source, as well as the strategy to implement the system in research laboratories in developing countries, will be covered.