First MHD equilibrium characterization and electromagnetic waves interaction on hydrogen plasma in the SCR-1 Stellarator

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On June 29, 2016 was an important day for science in Costa Rica; it becomes the first country in Latin America to produce a high temperature hydrogen plasma in a Stellarator. The Stellarator of Costa Rica 1 (SCR-1) is the device designed, constructed and implemented in Costa Rica for this purpose. It is a small-size modular stellarator ($R = 0.247 \text{ m, } <a> = 0.040 \text{ m, } R/a = 6.2$, the plasma volume is approximated $0.0078 \text{ m}^3$ and 10 mm thickness aluminum torus shaped vacuum vessel). The magnetic field strength at the center is around $43.8 \text{ mT}$ which is produced by 12 copper modular coils with 4.6 kA-turn each. This field is EC resonant at $R$ with a 2.45 GHz as second harmonic, from 2 kW and 3 kW magnetrons \cite{1}. We present the progress of the physics computer simulations and the recent experiments that have been done in SCR-1. We focus on the magnetic configuration and plasma parameters calculated by VMEC and the BS-SOLCTRA (Biot-Savart Solver for Compute and Trace Magnetic Fields) codes. This contribution, also, provides the study of the interaction between the plasma and the microwaves (2.45 GHz) taking in account the shape of the vacuum vessel. Our purpose is to explore all the possible scenarios of the electron Bernstein waves, which provide an efficient mechanism to heat the plasma, as it has been demonstrated in other stellarators \cite{2,3}. It is done by the full wave IPF-FDMC code \cite{4}. The first Langmuir probe and optical spectrometer measurements have been performed and used to obtain radial profiles of electron density and temperature. Finally, the most important results of the magnetic flux surface and field line tracing measurements are presented. These are the first steps of a long road, that thrill all the scientists who work or cooperate with the Plasma Laboratory in Costa Rica.

References

\cite{3} A. Köhn et al, Plasma Physics and Controlled Fusion 55, 1 (2013).  
\cite{4} A. Köhn et al, Plasma Physics and Controlled Fusion.52, 3 (2010).