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Hydrogen electron cyclotron resonance ion sources plasma  
characterization based on simple optical emission spectroscopy

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7 **Abstract**

Hydrogen electron cyclotron resonance ion sources plasma measurements based on simple optical emission spectroscopy on a new compact low current ion source designed and built by the authors is presented. By observing the plasma luminescence both directly and through a low-cost transmission diffraction grating, basic characterization of the Hydrogen plasma obtainable in the ion source is carried out. Through simple processing of CCD captures of these images, optimal values for the ion source relevant operation parameters, including RF power and frequency, and Hydrogen mass flow are easily obtained. Despite the simplicity of the method and its limited accuracy as compared to the use of a full standard optical spectrometric set-up, it is shown that the presented approach can cope with basic plasma diagnostic tasks as far as the successful operation of the ion source is concerned.

8 *Keywords:* , Ion Sources, Plasma, ECR, Optical Spectroscopy

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10 **1. Introduction**

11 Electron cyclotron resonance ion sources (ECRIS) have become one of the most  
12 common means for ion production in basic research and industry for a wide range of  
13 applications because of their reliability and capability to produce multiply charged  
14 ion beams from most stable elements [1]. The performance of the ion source is fun-  
15 damentally dependent on the ECR plasma production, which, in turn, depends on  
16 the microwave frequency and power used, the magnetic field's distribution and in-  
17 tensity, and the gas flow driven into the plasma chamber. The successful operation  
18 of an ion source requires that these variables be tuned and controlled.

19 The two key parameters of the plasma for ion production, density and tem-  
20 perature, are typically measured by means of different probes. Amongst them,

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