Title: Probing acoustics of a modulated plasma through the oscillations of its brightness

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I. Abstract Body (up to 250 words)

Developing a pulsed microwave lamp of 1 kW fitted with a static electrodeless spherical bulb filled with 28 mg of sulphur, that produces a very bright plasma, we have discovered a phenomenon in which the plasma forms a ball at the bulb centre, despite gravity. So doing, we avoid melting the glass. In a preceding publication, we reported photometric measurement showing the plasma response to the modulation of the microwaves. We have shown that the ball formation results from an acoustic resonance in a spherical mode. From the measure of its frequency, which lies a little below 30 kHz, we have furthermore assessed the average value of the pressure inside the bulb considering the dissociation of sulphur. At the resonance, the AC component of the signal changes to a sinusoidal signal of a slightly lower frequency. Beats appear indeed, resulting from the interference between the forced response and the excitation of the spherical mode which is due to a free oscillation. Besides, Professor Putterman's group at UCLA has reproduced the plasma ball formation with a similar setup, but with a spinning bulb so to stabilize the ball. From measurements of the oscillations of the ball diameter, they have moreover shown that the acoustic amplitude inside the bulb can reach 180 dB (re 20 mPa). In our case we have not measure these oscillations, but we have been able to assess the acoustic amplitude by improving our model, as shown in this article.

II. Image:

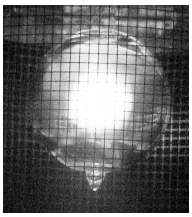


Figure 1 The plasma ball formation

III. Reference:

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IV. Biography:

Gilles Courret has completed his PhD at the Swiss Federal Institute of Technology (EPFL) in 1999. Since 2013 he is Professor of physics in the Department of Industrial Technologies of the University of Applied Sciences and Arts Western Switzerland (HES-SO). His research interests include microwave-plasma interaction, plasma chemistry, light sources and illumination engineering, with emphasis on the improvement of energy efficiency. He has published more than 20 papers in reputed journals

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