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Better protect our communications systems against electromagnetic attacks thanks to micro-discharges

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With the advent of planar circuit technologies, microwave wireless communication systems have become increasingly compact and integrated. However, with the accelerated development of high-power electromagnetic directed energy weapons (HP DEW) [1], their vulnerability has increased. The disruptive, even destructive, effects of these weapons on these electronic systems have for example been studied by Bäckström [2]. To protect against these threats, it is common to use microwave power limiting devices, generally based on diodes [3]. However, these semiconductor components are now showing their limits due to the increase in the power of aggression.

Recently, the authors have proposed a microstrip transmission line device integrating a microwave-sustained discharge for power limiting applications, but which can also be seen as a microwave plasma source [4]. This device consists of a multilayer structure made up of two parallel planar conductors, between which there is a dielectric slab and a cavity filled with Argon at 10 Torr where the microwave plasma is generated (see Fig. 1).

In this communication, we will present the operating principle and give an overview of the performance obtained experimentally and numerically, highlighting some of the key parameters that control its performance. Based on numerical and theoretical work, we will propose an interpretation of the coupling modes of the wave to the plasma in such structures. In particular, we will show that the plasma column is sustained by a leaky wave (i.e., the microwave power propagates in the dielectric and leaks into the plasma).

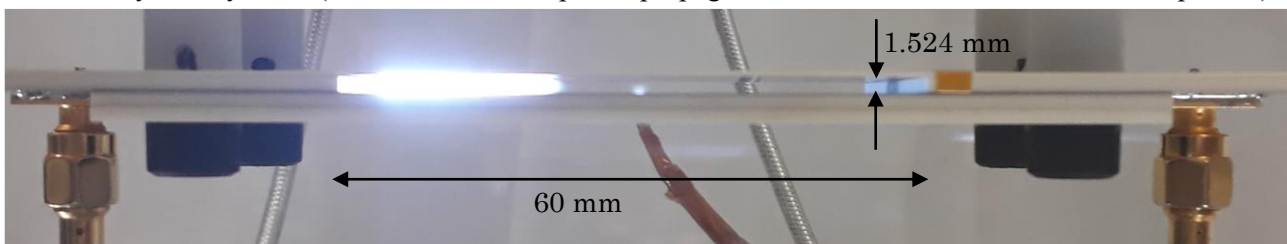


Fig. 1: Image of the plasma-based microwave power limiter in suspended microstrip technology. Argon at 10 Torr and CW signal at 3 GHz and 40 dBm (10 W).

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