Abstracts

The Dipolar Resonance of the Cylindrical Low-Pressure Arc Discharge

J.H. Battocletti. "The Dipolar Resonance of the Cylindrical Low-Pressure Arc Discharge." 1963 Transactions on Microwave Theory and Techniques 11.3 (May 1963 [T-MTT]): 193-203.

When an em wave of fixed frequency is incident on the cylindrical positive column of a low-pressure arc discharge, nearly complete absorption occurs at a definite value of discharge current I/sub 0/ as the discharge current is varied. I/sub 0/ yields a plasma electron density which corresponds to the well-known cylindrical, or dipolar, plasma resonance frequency f/sub 0/. The ratio f/sub p/ / f/sub 0/ where f/sub p/ is the ordinary (plane) plasma frequency, has been determined by others using a quasi-static approach. In this paper a dynamic approach is used, and comparison is made with the quasi-static approach. Agreement is within 3 per cent for values of beta/sub 0/a less than 0.25. For beta/sub 0/a equal to 0.60, the discrepancy in the quasi-static method is 15 per cent. Theoretical calculations as well as experimental evidence indicate that the electron sheath, which exists on the outside surface of the positive column, plays a significant role in the location of the dipolar plasma resonance. Application of the results of this paper improve the agreement between theory and experiment for the Plasma Microwave Coupler described by Steier and Kaufman.

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