Abstracts

Radiation Patterns of a Noise-Excited Thin Slot

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Theoretical and experimental radiation patterns are given in spectral form for the thermal radiation from a cylindrical discharge column which is adjacent to a long thin slot in a metallic plane. A spatial distribution is predicted which exhibits interference minima and maxima when the length of the slot and the wavelength of the emission are the same order of magnitude. The analysis is based on Maxwell's equations and the Leontovich-Rytov distributed source generalization of Nyquist's noise formula. Fraunhofer pattern measurements are presented in which an argon source is used to excite slots of 7.3pi and 9.5pi radians in length. Data are also presented to show the effects of variations in the pressure and the dc current of the discharge. The pattern measuring apparatus is a Dicke radiometer, having the following characteristics: frequency 9200 Mc, bandwidth to the detector 16 mc, modulation frequency 1000 cps, and residual noise level 0.3 rms°K. An interference phenomenon is predicted by the theory and demonstrated by an experiment, even though the source excitation is spatially distributed and essentially uncorrelated in time and in space. The patterns are not even approximately Lambertian, e.g., a thin slot of 9.5pi radians exhibits a pattern having nine relative maxima in 180°, with the maximum emission at 63° from the normal.

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