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On the Geometrical Optics Approach in the Theory of Freely-Localized Microwave Gas Breakdown MICHAEL SHAPIRO, SAMUEL SCHAUB, JASON HUMMELT, RICHARD TEMKIN, MIT Plasma Science and Fusion Center, VLADIMIR SEMENOV, Institute of Applied Physics, Nizhny Novgorod, Russia — Large filamentary arrays of high pressure gas microwave breakdown have been experimentally studied at MIT using a 110 GHz, 1.5 MW pulsed gyrotron. The experiments have been modeled by other groups using numerical codes. The plasma density distribution in the filaments can be as well analytically calculated using the geometrical optics approach [1,2] neglecting plasma diffusion. The field outside the filament is a solution of an inverse electromagnetic problem. The solutions are found for the cylindrical and spherical filaments [1] and for the multi-layered planar filaments [2] with a finite plasma density at the boundaries. We present new results of this theory showing a variety of filaments with complex shapes. The solutions for plasma density distribution are found with a zero plasma density at the boundary of the filament. Therefore, to solve the inverse problem within the geometrical optics approximation, it can be assumed that there is no reflection from the filament. The results of this research are useful for modeling future MIT experiments.

[1] V. B. Gildenburg and S. V. Golubev, ZhETF, vol. 67, p. 89, 1974.
[2] V. E. Semenov, Sov. J. Plasma Phys., vol. 10, p. 328, 1984.

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