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Title:Possible standoff detection of ionizing radiation Using high-power THz electromagnetic waves
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Abstract:Recently, a new method of remote detection of concealed radioactive materials was proposed. This method is based on focusing high-power short wavelength electromagnetic radiation in a small volume where the wave electric field exceeds the breakdown threshold. In the presence of free electrons caused by ionizing radiation, in this volume an avalanche discharge can then be initiated. When the wavelength is short enough, the probability of having even one free electron in this small volume in the absence of additional sources of ionization is low. Hence, a high breakdown rate will indicate that in the vicinity of this volume there are some materials causing ionization of air. To prove this concept a 0.67 THz gyrotron delivering 200-300 kW power in 10 microsecond pulses is under development. This method of standoff detection of concealed sources of ionizing radiation requires a wide range of studies, viz., evaluation of possible range, THz power and pulse duration, production of free electrons in air by gamma rays penetrating through container walls, statistical delay time in initiation of the breakdown in the case of low electron density, temporal evolution of plasma structure in the breakdown and scattering of THz

radiation from small plasma objects. Most of these issues are discussed in the paper. © 2012 SPIE.

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