

Quantitative Determination of the Breakdown Field of Air from Van de Graaff Generator Discharge

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Abstract — The Van de Graaff generator (VG) is ubiquitous in electrostatic demonstrations because of the large static charge and dramatic sparks produced. We have developed a novel technique for determining the breakdown field of air using the VG. When a spark occurs, the force of attraction between the VG and a discharge sphere suspended above it is measured by a Pasco force sensor. At this time the charge is not symmetric but pulled towards the near side of the spheres by mutual attraction. In order to interpret the measured force in terms of the breakdown field, an accurate model of the charge distribution is needed. Using the method of images for a spherical conductor in an iterative fashion we can provide this model. The electric field in the vicinity of the spheres is then calculated from the charge distribution and its maximum value is the breakdown field. In preliminary work, we determined the breakdown field to be 3.1×10^6 N/C at 24.9 C and 18% relative humidity. We will report our most recent determination of the breakdown field using this method and discuss the validity of the results in terms of accepted values, experimental limitations and sensitivity to the charge distribution model.