# Letters
## to the Editor

### Microwave Miscalculation

In the article "Microwave Mischief and Madness,"[1] the authors miscalculate the potential difference between two points in the electric field in a microwave oven: $\Delta V = (2 \times 10^3\ V/m)(1 \times 10^{-2} m) = 20$ V, not 20,000 V! I believe what is actually happening is that the metal conductor distorts the field, producing a very high gradient around any sharp edges or points. This leads to ionization of the air in this region, which then leads to a discharge or spark.


1. Heather Hosack, Nathan Marler, and Dan MacIsaac, *Phys. Teach.* **40**, 264–266 (May 2002).



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### Author Response

Mr. Bugel is correct in his critique: the calculation of electric field strength and its underlying assumptions used in the note are incorrect. Other readers including Professor Ed Karlow of La Sierra University also corresponded with me regarding this error.

In trying to develop a simple and correct calculation for this phenomenon, I corresponded with several people, including Mr. Bill Beatty and Dr. Bruce Sherwood of North Carolina State University. Sherwood outlined two analyses: one for a small rectangular piece of foil in an electric field and another based upon two charged conductive spheres in electric contact, both of which can produce near-surface electric fields sufficient to exceed the dielectric breakdown strength of air.

These analyses both depend upon conductors that have irregular dimensions (different radii of curvature) and can be viewed at http://purcell.phy.nau.edu/pubs/TPT/TPTMay02Microwave/analyses.pdf.

I would also like to direct the reader to an introductory-level, explicit treatment of the mechanics of sparks in air in Dr. Sherwood's book.[1]


1. Ruth Chabay and Bruce Sherwood, "Case Study: Sparks in Air," in *Matter & Interactions II: Electric & Magnetic Interactions* (Wiley, 2002), pp. 484-494.



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