advantage, both economically and performance-wise, that the radome enclosure offers. Is it possible that extrapolations from noncomparable experiences at Andover and/or from experiments which may not truly simulate actual physical conditions can be deterring our objective search? Perhaps two systems, one employing radomes of latest design, and one utilizing exposed antennas, should be deployed to accumulate definite operating data?

There are, of course, many other benefits of radome use, such as decreased maintenance, higher reliability, pointing and tracking accuracies under all environmental loads, reduced blockage due to subreflector support structures, etc. We have accumulated much data on these subjects.

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[1] I. Anderson, "Measurements of 20-GHz transmission through a radome in rain," *IEEE Trans. Antennas Propagat.*, vol. AP-23, pp. 619–622, Sept. 1975.
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Authors' Reply[2] [3]

We are glad that the aforementioned article[1] was of use and interest, and appreciate comments on it. There are four salient points in the comments that we would like to remark upon.

1) Enclosure of precision antennas in radomes certainly reduces overall cost because design and constructuion to accommodate wind load and the very important temperature effects are simplified.

2) If rain is encouraged to flow in rivulets down the radome, rather than as a uniform layer, the attenuation will be reduced considerably. But, two additional problems can arise. a) The phase shift and amplitude distortion of the field transmitted through and around the rivulets produce an aperture distribution not unlike a combined amplitude and phase grating; this gives rise to wide-angle radiation. b) Depolarization can occur, especially for circular polarization. However, the measurements of Evans *et al.* [3] and Watson *et al.* [4] show that very little depolarization occurs at 11 GHz when water is on either a radome or a reflector; in both cases the form of the water on the surfaces is unknown.

3) Path diversity using earth station sites separated by some tens of kilometers, is found to reduce the outage of millimeter-wave earth-space transmission significantly; our measurements are made using antennas without weather covers. Improvement would also be obtained if antennas with radomes were used, especially during the summer when the heavy showers (rainrates above 100 mm/h) are well isolated. However, wide-area storms in which showers are embedded in a general background of rain frequently occur. In those cases, the improvement would be much less on a system using present radomes; this is because the attenuation by the water layer increases so rapidly with rain rate (Fig. 46 of the original article[1]), rain rates of only 10 mm/h producing attenuations of 5 or 6 dB at 20 GHz. That amount of attenuation, along with the attenuation on the path produced by the background rain would seriously limit the effectiveness of the diversity site in some systems.

[2] Manuscript received January 17, 1976.
[3] D. C. Hogg and T. S. Chu are with Bell Laboratories, Crawford Hill, Holmdel, NJ 07733.

4) The effect of rain on the reflector gain is small as shown in a recent experiment [5] on guidance of 100 GHz beams. When a reflector surface coated with a *wetting* paint to prevent beading was thoroughly sprayed with water, the measured attenuation due to the wetness was found to be about 0.1 dB. The reflection coefficient of a reflector surface coated with a thin dielectric layer is relatively insensitive to the dielectric thickness and has approximately the same amplitude and phase shift [6] as in the absence of the dielectric. Therefore, the increase of wide angle radiation and depolarization due to nonuniform water film thickness on a reflector surface is expected to be small.

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[3] B. G. Evans *et al.*, "Investigation of the effects of precipitation on parabolic antennas employing linear orthogonal polarization at 11 GHz," *Electronics Letters*, vol. 7, pp. 375–377, July 1, 1971.
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[5] J. A. Arnaud and J. T. Ruscio, "Guidance of 100 GHz beams by cylindrical mirrors," *IEEE Trans. Microwave Theory and Techniques*, vol. MTT-23, pp. 377–379, April 1975.
[6] T. S. Chu and R. A. Semplak, "A note on painted reflecting surfaces," *IEEE Trans. Antennas and Propagat.*, vol. AP-24, pp. 99–101, Jan. 1976.

Correction to "The Edge Condition in Electromagnetics"

R. A. HURD

In the above succinct paper,[1] two square roots were inadvertently omitted. In (7), the quantity $\varepsilon_1\varepsilon_3/\varepsilon_2$ should be inside a square root; and a square root should enclose the entire right-hand side of (11).

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[1] R. A. Hurd, *IEEE Trans. Antennas Propagat.*, vol. AP-24, pp. 70–73, Jan. 1976.

Correction to "Dispersion Relations for Parallel-Plane Waveguide Containing Transversely Magnetized Uniaxial and Warm Plasma in Relative Motion"

G. N. TIWARI, DINESH SINGH, AND S. K. TOLPADI

In the above communication,[1] the problem of electromagnetic wave propagation in a parallel-plane waveguide containing a relativistically moving uniaxial warm plasma in the presence of a strong transverse magnetic field was considered. An error was made in deriving the wave equations so the expression for dispersion relation is incorrect.

In the present communication, the modified governing equations are derived without imposing any restriction on the velocity of the plasma medium. One can write wave equations for TE,

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[1] P. K. Jain, D. Singh, P. N. Gupta, and S. K. Tolpadi, *IEEE Trans. Antennas Propagat.* (Commun.), vol. AP-21, pp. 743–744, Sept. 1973.