COMMENT ON "A DISAPPEARING ROD"

In the recent note "A disappearing rod" [Am. J. Phys. **55**, 177 (1987)], Terrence P. Toepker purports to show that upon heating and cooling nuclear fuel rods, they could be made to shrink into something like a black hole. Surely he is jesting. As the author states in his second paragraph "Just for fun...," one must take him lightly for it is relatively easy to show a discrepancy in his derivation.

Following the author "...consider a metal rod whose length L_0 is much longer than its cross-sectional dimensions." This is of course at the temperature T_0. Then using the common relation for the length at any other temperature one may write that the length L at any temperature T will be given by

$$L = L_0[1 + \alpha(T - T_0)], \qquad (1)$$

where α is the linear expansion coefficient. This linear relation may be considered as a modified state equation.

The rod is now heated to a temperature T_h when the length will be L_h or

$$L_h = L_0[1 + \alpha(T_h - T_0)] = L_0[1 + \alpha(dT_h)], \qquad (2)$$

where

$$(dt_h) = T_h - T_0. \qquad (3)$$

Let us now cool the rod to some temperature T_c at which the length will be L_c so that

$$L_c = L_0[1 + \alpha(dT_c)], \qquad (4)$$

where

$$(dt_c) = T_c - T_0. \qquad (5)$$

In this case, if $T_c = T_0$ then of course $L_c = L_0$, so that the rod cools to the same length as it was in the beginning. The discrepancy occurs when the author writes Eq. (4) with L_h substituted for L_0 and T_h substituted for T_0 in Eq. (5).

One obtains Eq. (1) via experimentally determining the rod length at many different temperatures over the range of usage. Normally, this is not a straight line, but over a short length change it may be approximated by a straight line due to the usual limitations on experimental measurements. Then taking any two points on this line segment, say T_p, L_p and T_q, L_q, one solves Eq. (1) for L_0 and α. They may be shown to be

$$\alpha = (L_q - L_p)/(L_pT_q - L_qT_p) \qquad (6)$$

and

$$L_0 = (L_pT_q - L_qT_p)/(T_q - T_p), \qquad (7)$$

where T_0 is 0 (without loss of generality).

One notes that these values are independent of the temperatures T_h and T_c. Therefore, the author is not justified in changing the value of L_0 for the cooling portion of the experiment, wherein lies the discrepancy.

One must admit that for engineering purposes, the use of a negative dT and the present length for L_0 may be accepted when the temperature changes are small. However, to use this approximation in the case under investigation is clearly not justified.

If the editors wish to continue the publication of such spoofs, then perhaps they could place them in a special section of the magazine, so labeled.

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16 April 1987

EARNSHAW AND THOMSON'S PROBLEM

Readers of the *American Journal of Physics* who have tended to believe the Berezin approach to solving "Thomson's Problem" and the idea that electric charges can adopt mutually stable configurations in their electric interactions, must have been startled by the letter of H. Aspden[1] in your March issue.

The "aether" as perhaps a reality seems to demand attention, as an ideal medium that can breach Earnshaws classic theorem.

Some light on this subject is emerging on the experimental front from investigation of the modulation of standing waves in a laser beam not set up by direct retroreflection. The modulation of the beam, as found by scanning along it with a wave sensor, reveals evidence of spatial anisotropy indicative of motion of the laboratory through space at close to 400 km/s. This appears to have been confirmed by independent researchers in USA and Austria. It means that "absolute space" or a "preferred reference frame" is a reality and that a physical "aether" may also be a reality. This then gives support to the followers of Berezin's methods, which circumvent Earnshaws theorem.

I write this letter as Editor of *Progress in Space-Time Physics 1987*,[2] which has just been published and which comprises 28 research articles, including the first published accounts of the two experiments just mentioned.

The credit for the brilliant experimental technique by which motion through space has been detected using simple laser interferometry goes to E. W. Silvertooth, who has been working under U.S. Air Force sponsorship. What is remarkable, however, is that this achievement appears not to be receiving publicity in USA in scientific journals.

Can it be that belief in Einstein is so strong that we no longer pay attention when new and relevant experimental facts come to light? Yet, as Aspden implies, even J. J. Thomson had the sense to ignore Earnshaw's theorem, in the interests of advancing our knowledge, so why it is that our minds are so closed on the "aether" question?

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27 May 1987

[1] H. Aspden, Am. J. Phys. **55**, 199 (1987).
[2] J. P. Wesley, *Progress in Space-Time Physics 1987* (Benjamin Wesley, Blumberg, West Germany, 1987).