

one. There is unhappiness that Nature lent its reputation to the piece.

How would one designate this particular conflict from the 1980s?

Reference

1. T. Theocharis, M. Psimopoulos, *Nature* **329**, 595 (1987).

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A Proposal for Rescaling Units

Several physical quantities are thought of as having “obvious” upper or lower bounds in their magnitudes. Temperature, for example, cannot go below absolute zero, the magnitude of any velocity is at most c , the speed of light, and time cannot go back past the Big Bang.

In life outside the laboratory, we never get very close to any of these bounds, so they pose no problem. However, researchers in cryogenics,

cosmology, and high-energy physics work at values that are perceived to be close to these limits. We read of temperatures one one-hundredth of a degree above absolute zero (that is, 0.01 K); of velocities at 99.95% of the speed of light; and of the state of the cosmos at 10^{-8} seconds after the Big Bang. In these cases, the standard system of units is inconvenient. Getting three orders of magnitude closer to 0 K, or to the time of the Big Bang, or to the speed of light, should not be obscured by the appearance that the change is merely an infinitesimal improvement.

A change of units that maps zero to minus infinity and, in the case of velocity, maps c to plus infinity makes it easier to appreciate improvements that get closer to these bounds by orders of magnitude. This principle has been in use for a long time by engineers who measure changes in intensity in decibels (dB), where an increase or decrease by n orders of magnitude is a change of $+10n$ dB or $-10n$ dB, respectively.

For physical quantities like time and temperature, the new units may simply be taken as the common logarithms of the old units. Using **T** to represent the new unit of temperature, we set $1 \text{ K} = 0 \text{ T}$ with $(10^n) \text{ K} = n \text{ T}$ for negative as well as positive values for n . Thus, $0.01 \text{ K} = -2 \text{ T}$. More generally, $x \text{ K} = (\log_{10} x) \text{ T}$, for any positive real number x . A similar approach applies to time since the Big Bang, where “ x seconds after the Big Bang” becomes $(\log_{10} x) \text{ U}$, where **U** is our new, logarithmic measure of time.

For velocity magnitudes v , with $0 \leq v \leq c$, we can rescale to **V** = $\tan^{(\pi/2c)} v$, with $0 \leq V \leq +\infty$. At $v = \frac{1}{2} c$, this gives **V** = $\tan^{(\pi/4)} = 1$.

For nanotechnology researchers, the lower limit of zero for weight, length, and so forth can be moved to minus infinity by the same logarithmic technique used above for time and temperature. Names and symbols for these new units should be recommended by appropriate standards committees for each of the research areas involved.

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Strings 2000's Top 10 Bemuse Belfast

David Mermin is entitled to disagree with the list of top 10 questions in fundamental physics (PHYSICS TODAY, February 2001, page 11), but