Approximations of the fine structure constant reciprocal

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Abstract

A "brute force" computer search was made for the most accurate approximations of the experimental fine structure constant reciprocal in the form $\frac{A^a - D^d}{B^b} + C^c - E^e$, where A, B, C, D, and E were integers ranging from 0 to 30, while the exponents a, b, and c, were integers ranging from 0 to 3, and d and e were integers ranging from 0 to –3. Within these restrictions, and ignoring all trivial variants, a fit better than or equal to 137.036 was achieved only twice, by $\frac{10^3 - 10^{-3}}{3^3} + 10^2 - 10^{-3} = 137.036$ and $\frac{22^3 - 2^{-1}}{25^2} + 11^2 - 1^{-1} = 137.036$, where the search employed a fine structure constant inverse equaling its 2006 CODATA value of 137.035999679. The comparative simplicity of the first of these approximations, its symmetrical reuse of the constant 10, and the small size of its integers, together suggest its origin may be physical, and that the integers 10 and 3 may be important physical constants.

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$$\frac{10^3 - 10^{-3}}{3^3} + 10^2 - 10^{-3} = 137.036 \tag{1}$$

and

$$\frac{22^3 - 2^{-1}}{25^2} + 11^2 - 1^{-1} = 137.036 \quad , \tag{2}$$

where the search employed a fine structure constant inverse equaling its 2006 CODATA value of 137.035999679 [1]. The comparative simplicity of Eq. (1), its symmetrical reuse of the constant 10, and the small size of its integers, together suggest its origin may be physical, and that the integers 10 and 3 may be important physical constants.

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[1] P. J. Mohr, B. N. Taylor, and D. B. Newell (2007), "The 2006 CODATA Recommended Values of the Fundamental Physical Constants" (Web Version 5.0). This database was developed by J. Baker, M. Douma, and S. Kotochigova. Available: http://physics.nist.gov/constants [2007, July 12]. National Institute of Standards and Technology, Gaithersburg, MD 20899.