Approximating fine-structure constant with fractional elementary charges ignoring charge dimensions

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Abstract

Fine-structure constant, also known as Sommerfeld's constant, commonly denoted by α (the Greek letter alpha), is a fundamental physical constant characterizing the strength of the electromagnetic interaction between elementary charged particles. It has couple of equivalent definitions like :

$$\alpha = \frac{1}{4\pi\varepsilon_0}\frac{e^2}{\hbar c} = \frac{\mu_0}{4\pi}\frac{e^2 c}{\hbar} = \frac{k_\mathrm{e} e^2}{\hbar c} = \frac{e^2}{2\varepsilon_0 c h} = \frac{c\mu_0}{2R_\mathrm{K}} = \frac{e^2 Z_0}{2h} = \frac{e^2 Z_0}{4\pi\hbar}$$

In current paper we try to approximate fine-structure constant with fractional elementary charge expressions, ignoring charge measurement units, using only elementary charge absolute value of $1.602176634 \times 10^{-19}$.

Straight approximation with single elementary charge

$$\alpha = \left(\frac{1}{3}e\right)^{1/9} \qquad \text{(Equation 1)}$$

Where e is elementary charge absolute value with units $[C^0]$

Approximation with a reduced charge

Equation 1 can be re-written using reduced charge expression, like that :

$$\alpha = \left(\frac{e \cdot e/2}{e + e/2}\right)^{1/9} \qquad \text{(Equation 2)}$$

Both equations 1,2 gives approximated fine-structure constant with relative error of $\approx 1\%$

Conclusions

Fine-structure constant can be roughly approximated with fractional elementary charge expressions. It’s interesting to note that in equation 1 fractional elementary charge is the same as for down-type antiquark elementary particle. Equation 2 can be interpreted as electric dipole consisting of elementary charge and some quasi-particle with fractional $1/2e$ charge. But of course these coincidences can be purely sporadic. This approximation list is neither final, nor complete.