# The fine structure constant: A radiative series leading to it's exact value

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**Abstract**

A Mclauren like series expansion method produces a simple radiative series for the low energy limit of the fine structure constant which is exact to within all experimental digits with a deviation of the experimental mean $\epsilon < 10^{-10}$.

## 1 Alpha series

A function's complete description in the form of a McLauren expansion needs in principle only the the information from a single point and its infinitesimal small environment. A similar "McLauren like" method is used here to derive a series with radiative corrections from the single (yet highly accurate) value $\alpha$. The only tricky point is to find the value to which the series converges. The successful ansatz turned out to be a Gaussian constant:

$$\sqrt{\alpha} \; \approx \; e^{-\pi^2/4} \tag{1}$$

From here on we can develop a series $\Gamma$ with radiative corrections by taking successive differences so that we can write for the value of alpha:

$$\alpha \; = \; \Gamma^2 e^{-\pi^2/2} \tag{2}$$

resulting in:

$$\Gamma \; = \; 1 + \frac{\alpha}{(2\pi)^0}\left(1 + \frac{\alpha}{(2\pi)^1}\left(1 + \frac{\alpha}{(2\pi)^2}\left(1 + ........\right)\right)\right) \tag{3}$$

This series converges straightforward to reproduce the value of the fine structure constant exact in all its digits when compared with the latest Codata 2004 value:

$$\begin{array}{ll} \text{uncorrected ansatz:} & 0.007\underline{19188335582} \\ \text{correction to order 1:} & 0.0072972\underline{2791748} \\ \text{correction to order 2:} & 0.007297352\underline{54562} \\ \text{correction to order 3:} & 0.0072973525\underline{6865} \\ \text{experimental value:} & 0.007297352568 \;\; (\pm 24) \end{array} \tag{4}$$

Leading to a value of $\alpha$ with an overall precision better than one in ten billion! (not withstanding the sigma of $\pm 24$). Further evaluation of the above series leads to a value with an increased precision:

$$\alpha \; = \; 0.0072973525686538534 2269 \tag{5}$$

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