# Mathematical expression for the fundamental physical constant - Fine Structure Constant

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The dimensionless Fine Structure Constant (FSC)  $\alpha \approx 1/137$  has been introduced in 1916 by Arnold Sommerfeld for the description of the energy levels which have been found out experimentally in atomic spectra. Since then a number of examples showing importance of FSC in various phenomena had been revealed. Physicists have gradually realized the importance of this Constant. All the basic properties and characteristics of microscopic objects: properties of elementary particles, the sizes of electronic orbits in atoms, energy of interaction between atoms and molecules and by that, all physical and chemical properties of materials are determined by the value of this Constant. Further on, using FSC, it has become possible to develop a well known modern Quantum Electrodynamics (QED), with a fantastic accuracy of describing quantum electromagnetic interaction.

However the problem of a theoretical explanation of FSC is not solved till now. It was not possible to find a mathematical procedure of evaluating of FSC (similarly to the $\pi$ number).

The well-known theoretical physicist of the 20-th century Richard Feinman said about FSC: "It has been a mystery ever since it was discovered more than fifty years ago, and all good theoretical physicists put this number up on their wall and worry about it. Immediately you would like to know where this number for a coupling comes from: is it related to $\pi$ or perhaps to the base of natural logarithms? Nobody knows. It's one of the greatest damn mysteries of physics: a magic number that comes to us with no understanding by man" (QED: The Strange Theory of Light and Matter, 1985, p.129).

In 1999 Russian academician V.L.Ginzburg wrote: « the Theoretical physics cannot answer a lot of questions yet, for example: how to construct a quantum theory of gravitation, ..., how to theoretically define the Fine Structure Constant ... » (Uspekhi Fizicheskikh Nauk, 1999, №4, p.426).

FSC is related to other physical constants by the ratio $\alpha = e^2/2\varepsilon_0 hc$. Exact value of FSC is determined by the CODATA committee by using a relations with other constants measured experimentally such as $e/h$, $e^2/h$ and others.

The author, on the basis of the developed electron model *«The Electron as a Torus of a Displacement Current, and the Fine Structure Constant as a Parameter of the Torus»,* has managed to detail the given model regarding a magnetic field of an electron and to gain expression for energy of a magnetic field in the form of the sum of convergent mathematical series:

$$\frac{1}{4 \cdot \alpha} = (1 + \alpha) \cdot \left[ 1 + \sum_{n=1}^{\infty} \frac{6}{n \cdot (1 + \alpha \cdot n)} \right]$$

Solving this equation by means of MatLab, value  $1/\alpha$  equal 137.0156969748 is gained. For the reference: value  $1/\alpha$, agreed and recommended by the International CODATA Committee in 2010, is equal 137.035999094 (44).

Conclusion:

1. Mathematical expression for FSC is suggested that is not explicitly related to any other constants.

2. This result confirms author's model of the electron and opens a new path for building-up models of atoms and molecules, their spectral and other properties.

3. The accuracy of FSC evaluation is not sufficient and requires further investigation.

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