30(1): The Lamb Shift from n Theory

(ref. www.courses.washington.edu/phys432/Lamb-shift/lamb-shift.pdf)

The energy levels of the H atom in the Dirac theory are given by:

$$E_{nj} = E_n\left(1 + \left(\frac{\alpha}{n}\right)^2\left(\frac{n}{j+1/2} - \frac{3}{4}\right)\right) \quad -(1)$$

where E_n denotes the non-relativistic energy levels of H:

$$E_n = -\frac{\mu e^4}{32\pi^2\epsilon_0^2\hbar^2 n^2} \quad -(2)$$

where n is the principal quantum number. In eq. (1) α, the fine structure constant:

$$\alpha = \frac{e^2}{4\pi\epsilon_0\hbar c} \quad -(3)$$

The quantum numbers obey the rules:

$$j = \ell \pm s \quad -(4)$$

$$= \frac{1}{2}, \frac{3}{2}, \ldots, n - \frac{1}{2}$$

and

$$\ell = 0, \ldots, n-1 \quad -(5)$$

In theory (4FT 428):

$$E_n = -\frac{\hbar^2}{2m}\int \psi^* \frac{1}{n(r)^{1/2}} \nabla^2 \psi \, d\tau - \frac{\hbar^2}{2m}\int \psi^* \nabla\left(\frac{1}{n(r)^{1/2}}\right)\cdot\nabla\psi \, d\tau$$

$$-\frac{e^2}{4\pi\epsilon_0}\int \psi^* \frac{n(r)^{1/2}}{r}\psi \, d\tau \quad -(6)$$

2) So the relativistic Lamb shift is evaluated from eqs. (1) and (2).

This will produce a Lamb shift between $2S^{1/2}$ and $2P^{1/2}$.

In the usual theory:

$$n(r) = 1 \quad -(7)$$

and there is no Lamb shift because:

$$\left.\begin{aligned} 2P_{1/2} &: n=1,\ L=1,\ S=-1/2,\ J=1/2 \\ 2S_{1/2} &: n=1,\ L=0,\ S=1/2,\ J=1/2 \end{aligned}\right\} -(8)$$

and n and J are the same for $2P_{1/2}$ and $2S_{1/2}$. So for eq. (1) there is no energy difference between $2P_{1/2}$ and $2S_{1/2}$. There are also Lamb shifts between $3S_{1/2}$ and $3P_{1/2}$ states and $3P_{3/2}$ and $3D_{3/2}$. All of these shifts can be explained to any precision by a choice of $n(r)$.

Quantum electrodynamics is well known to be a complicated and dubious procedure, heavily criticized by Dirac and Feynman, so to replace Q.E.D. by $n(r)$ they is a major step forward. The problems with Q.E.D. include renormalization and divergent regularization, the concept of virtual particles, and lose parameters. In quantum electrodynamics the

) interaction between an electron and proton is the 1-1 exchange
mediated by a photon carrying of a pair of virtual
particles. The virtual particles can never be
observed directly, violating Baconian principles.

In terms of this interaction between the
electron and the proton is:

$$U = -n(r)\frac{e^{1/3}}{4\pi\epsilon_0 r} \quad -(9)$$

but is a much simpler idea.

Therefore eqs. (1) to (4) can be used to
replace quantum electrodynamics by a much simpler
theory of the Lamb shift, not only in atomic H but
in all atoms and molecules. The confirmed results
of this theory in UFT 415 to UFT429 are already
much more incisive than the standard model.
