Chapter 6

Application of Einstein-Cartan-Evans (ECE) Theory to atoms and molecules: Free electrons at resonance

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Abstract

The ECE theory is applied to atoms and molecules, using the hydrogen (H) atom as an example. The ECE wave equation is used in the non-relativistic quantum limit (Schrödinger equation) but the generally covariant Coulomb law is used, incorporating the spin connection of ECE space-time. All Coulombic interactions in atoms and molecules must be generally covariant, meaning that the spin connection must be used. This realizations opens up many new possibilities, in particular the ionization of the atom or molecule by tuning the spin connection. This is not possible in the standard model, even on a conceptual level, because the latter in electrodynamics is a theory of special relativity with no spin connection.

Keywords: Einstein Cartan Evans (ECE) field theory; spin connection, atoms and molecules, H atom, space-time resonance, new energy.

is changed to:

$$\Box q^a_\mu = (R + R_1 + R_2) q^a_\mu \tag{6.117}$$

In the Dirac limit the extra curvatures R_1 and R_2 are defined by:

$$| R_1 | = \frac{e^2 A^*_a A^a}{\hbar^2}, \quad | R_2 | = \frac{emc\gamma^a (e^2 A^*_a + A^a)}{\hbar^2} \tag{6.118}$$

This process is effectively a minimal prescription in which $\boldsymbol{\nabla}$ is changed to

$$\boldsymbol{\nabla} \rightarrow \boldsymbol{\nabla} - \frac{ie}{\hbar}\boldsymbol{A} \tag{6.119}$$

Therefore in this case the spin connection is:

$$\boldsymbol{\omega} = -\frac{ie}{\hbar}\boldsymbol{A} \tag{6.120}$$

The modulus of Eq.(6.119) gives:

$$\hbar\kappa = eA^{(0)} \tag{6.121}$$

where

$$\kappa = | \boldsymbol{\omega} | \tag{6.122}$$

is a wave-number and magnitude of the spin connection. Eq.(6.120) describes the absorption of a photon of energy $\hbar\omega$, momentum $\hbar\kappa$ and angular momentum $\pm\hbar$. It can be seen that the photon originates in the spin connection of space-time itself. In this process the kinetic energy operator of the Schrödinger equation is changed as follows:

$$-\frac{\hbar^2}{2m}\nabla^2 \rightarrow -\frac{\hbar^2}{2m}(\boldsymbol{\nabla} - \boldsymbol{\omega})^2 \tag{6.123}$$

Thus:

$$\nabla^2\psi \rightarrow ((\boldsymbol{\nabla} - \boldsymbol{\omega}) \cdot (\boldsymbol{\nabla} - \boldsymbol{\omega}))\,\psi \tag{6.124}$$

and the process of photon absorption by an atom is described by the resonance equation:

$$-\frac{\hbar^2}{2m}(\nabla^2 - \boldsymbol{\omega} \cdot \boldsymbol{\nabla} - \boldsymbol{\nabla} \cdot \boldsymbol{\omega} + \omega^2)\psi = (E - V)\psi \tag{6.125}$$

where V is the resonant Coulombic term of ECE theory.

6.4 Suggested numerical methods in density functional code

Starting with the H atom, density functional code can be run with the standard Coulomb potential to give base line output. The latter describes the well known $2n^2$ - fold degeneracy of the H atom [22], where n is the principal quantum number. Electron spin produces $s = \pm 1/2$, doubling the degeneracy from n^2 - fold. This high level of degeneracy is not present if the potential energy V does not vary as $1/r$ [22], i.e. the degeneracy is caused by the use of the Coulomb potential. In ECE theory the degeneracy is removed at resonance, but remains in an off resonance condition. This should be demonstrated numerically by using the ECE resonance equation:

$$\nabla^2\phi - \boldsymbol{\nabla}\cdot(\boldsymbol{\omega}\phi) = \frac{\rho}{\epsilon_0} \tag{6.126}$$

at the point in the density functional code where the Coulomb potential is normally coded. The standard density functional code is then resumed and the output graphed and animated. This process can be repeated in any atom or molecule or material such as a crystal which can be described by contemporary density functional code. The spin connection enters into all areas of quantum mechanics in which the Coulomb potential is used, for example the electron to proton, electron to electron and proton to proton terms in the Dirac or Schrödinger equations. Use of the generally covariant ECE wave equation [1]–[17] will show the effect of gravitation on atomic and molecular quantum mechanics, an entirely new subject area in the natural and life sciences, for example DNA studies and genetics. ECE theory also applies [1] to the electro-weak field (radio activity) and the strong nuclear force between a neutron and a proton in a nucleus. The interaction of the strong, electromagnetic and gravitational fields inside a nucleus determines for example the natural abundance of the elements, and here again, ECE theory applies, with concomitant space-time resonance equations. At a sub nuclear level, ECE theory determines the science of quarks and gluons, and elementary particle theory.

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Bibliography

[1] M. W. Evans, Generally Covariant Unified Field Theory (Abramis 2005) vol.1.

[2] M. W. Evans, ibid., vols. 2-4, (in press, 2006 - 2007, www.aias.us and www.atomicprecision.com).

[3] L. Felker, The Evans Equations of Unified Field Theory (preprint on www.aias.us and www.atomicprecision.com).

[4] H. Eckardt and L. Felker, paper on www.aias.us and www.atomicprecision.com, H. Eckardt, papers on these websites.

[5] M. W. Evans, Generally Covariant Dynamics(paper 55) of the ECE series, in volume 4 of ref. (1), preprints on www.aias.us and www.atomicprecision.com)

[6] M. W. Evans, Geodesics and the Aharonov Bohm Effects (paper 56 ECE series).

[7] M. W. Evans, Canonical and Second Quantization in Generally Covariant Quantum field Theory (paper 57 of ECE series).

[8] M. W. Evans, The Effect of Torsion on the Schwarzschild Metric and Light Deflection due to Gravitation (paper 58 of ECE series).

[9] M. W. Evans, The Resonance Coulomb Law from ECE Theory: Application to the Hydrogen Atom (paper 59 of ECE theory).

[10] M. W. Evans, papers and letters in Found. Phys. Lett., and Found. Phys., 1993 to present, developing O(3) electrodynamics and ECE theory.

[11] M. W. Evans (ed.), Modern Nonlinear Optics, a special topical issue of I. Prigogine and S. A. Rice (series eds.), Advances in Chemical Physics (Wiley Interscience, New York, 2001. 2nd ed.), vols. 119(1) to 119(3).

[12] M. W. Evans and S. Kielich (eds.), first edition of ref. (11), (Wiley Interscience, New York, 1992, reprinted 1993 and 1997), vols. 85(1) to 85(3).

[13] M. W. Evans and L. B. Crowell, Classical and Quantum Electrodynamics and the $\boldsymbol{B}^{(3)}$ Field (World Scientific, New Jersey, 2001).

[14] M. W. Evans and J.-P. Vigier, The Enigmatic Photon (Kluwer, Dordrecht, 1994 to 2002, hardback and softback), vols. 1 - 5.

[15] M. W. Evans and A. A. Hasanein, The Photomagneton in Quantum field Theory (World Scientific, New Jersey, 1994).

[16] M. W. Evans, The Photons Magnetic Field (World Scientific, New Jersey, 1992).

[17] M. W. Evans, Physica B, 182, 227, 237 (1992), the first $\boldsymbol{B}^{(3)}$ papers.

[18] Feedback sites to www.aias.us and www.atomicprecision.com, indicating intense worldwide interest for two and a half years in the natural and engineering sciences and related areas.

[19] Mexican Group results affiliated to AIAS, observed independently, National University of Mexico Conference, February 2006.

[20] S. P. Carroll, Space-time and Geometry, an Introduction to General Relativity (Addison Wesley, New York, 2004).

[21] L. H. Ryder, Quantum Field Theory (Cambridge Univ Press, 1996, 2nd. ed.).

[22] P. W. Atkins, Molecular Quantum Mechanics (Oxford Univ. Press., 1983, 2nd. ed.).

[23] J. B. Marion and S. T. Thornton, Classical Dynamics of Particles and Systems (HB College Publishers, New York, 1988, 3rd. Ed.), chapter 3.

[24] Indicated by several independent contributions and discussion on www.aias.us and www.atomicprecision.com.

[25] E. G. Milewski (Chied Ed.), The Vector Analysis Problem Solver (Research and Education Association, New York City, 1987).

[26] H. Eckardt, e mail communications, and density functional code packages.

[27] J. D. Jackson, Classical Electrodynamics (Wiley, New York, 1998, 3rd. ed.).

[28] see discussion on linear inhomogeneous differential equations and Q factors in ref. (23).