ON THE USE OF MICROWAVE IRRADIATION IN THE KURATA / B(3) PROCESS.

by

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ABSTRACT

It is shown that the use of microwave irradiation greatly increases the theoretical efficiency of the Kurata / B(3) process over a process with visible frequency irradiation. A torque is formed between the spin magnetic dipole moment of an individual free electron in an ion or paramagnetic material and the $\underline{B}^{(3)}$ field that is fundamental to both the Kurata / B(3) process and to the Einstein Cartan Evans (ECE) unified field theory. This is the driving torque of a classical Euler resonance process in which the restoring torque is a linear harmonic oscillator due to a the catalytic mould. The inertial term completes the Euler equation. The angular displacement due to this process is proportional to beam power density and inversely proportional to angular frequency. At resonance, Kurata / B(3) dissociation occurs.

Keywords: ECE and B(3) theory, Kurata / B(3) process, microwave irradiation.

1. INTRODUCTION

It has been inferred independently by T. Kurata {1} that general relativity is not complete without consideration of what he identifies as "spin". In ECE theory "spin" is incorporated precisely into general relativity as spacetime torsion, defined by the first Cartan structure equation {2}. The structure of Cartan's differential geometry is used to develop a generally covariant unified field theory known after Einstein and Cartan as Einstein Cartan Evans (ECE) theory {3 - 12}. The electromagnetic field in ECE theory is within a proportionality the torsion tensor of Cartan, a vector valued differential two - form. The latter is related to the Riemann torsion tensor by use of the well known Cartan tetrad {2 - 12}. It is incorrect to try to develop differential geometry and general relativity without the use of torsion, which is fundamental in ECE theory to electrodynamics.

The upper index of the torsion two - form of Cartan is labelled a, and the lower two indices by μ and ν. The upper index in the ECE theory of electrodynamics is identified as polarization {3 - 12}. In a four-dimensional spacetime there are four polarizations: (0), (1), (2), and (3). These are timelike (0), two transverse senses ((1) being the complex conjugate of (2)), and longitudinal, labelled (3). There is a cyclical relation between (1), (2) and (3), the three spacelike polarizations. This cyclical relation defines the complex circular representation of space, a natural representation for circularly polarized radiation. In ECE theory and B(3) theory the longitudinally aligned and radiated magnetic flux density $\mathbf{B}^{(3)}$ always exists in, and is defined by, circularly polarized radiation.

The $\mathbf{B}^{(3)}$ component of the radiation has been related to angular momentum in many ways {3 - 12} and in Kurata's words, is the spin wave that is the basis of his industrial process. On a philosophical plane the $\mathbf{B}^{(3)}$ field is the object that transforms electrodynamics from the nineteenth century view of Maxwell and Heaviside (MH theory) to the present day view, based on geometry and ECE theory. MH theory is not based on geometry and is a theory of special relativity accompanied by the massless photon, a mathematical abstraction. In MH theory and in U(1) gauge theory, the idea of a massless photon is used to claim that only states (1) and (2) exist in the free electromagnetic field. States (0) and (3) are removed artificially, using the Gupta Bleuler method, resulting in the unphysical E(2) group {13, 14} and only two states of helicity. This type of obsolete dogma rested upon the idea that the lagrangian be invariant under the U(1) gauge transformation. The ECE theory is based on geometry and is therefore based on general relativity. It was intended from the outset to incorporate the B(3) theory and O(3) electrodynamics into general relativity. This is not possible either with MH theory or with Einstein Hilbert (EH) relativity, one in which torsion is missing axiomatically and incorrectly.

The $\underline{B}^{(3)}$ field is incorporated through use of the spin connection term in the first Cartan structure equation, a procedure which means the electromagnetic field becomes the spinning and translating frame of reference. The movement of the frame is essential to the development of a generally covariant unified field theory in which gravitation and electromagnetism are both described with four field equations, having the same geometrical structure. In the dogmatic procedures of the twentieth century there was a deep schism, because electromagnetism was not on the same philosophical footing as gravitation, and the latter was an incorrect theory based on Riemann curvature.

Therefore in order to understand the new and clean industrial revolution known as Kurata / B(3) technology {1} it is essential firstly to incorporate $\underline{B}^{(3)}$ into electrodynamics, and secondly to understand the way in which its effect is amplified by catalytic moulds. In Section 2 therefore the theory initiated in UFT 183 on www.aias.us is extended to include the torque between $\underline{B}^{(3)}$ and the spin angular momentum of an electron in an ion or paramagnetic material. The magnitude of this torque is shown to be proportional to the power density in watts per square metre of the electromagnetic irradiation used in the Kurata / B(3) process, and inversely proportional to the square of the angular frequency of the radiation in radians per second. The torque is increased by orders of magnitude by changing the frequency from visible to microwave for a given power density. The torque is considered to be the driving torque of an Euler resonance equation in which the restoring torque is due to the catalyst. The restoring torque is modelled with a linear harmonic oscillator. At resonance the angular displacement goes to infinity, and this process is considered to dissociate the bonds in a hydrogen rich hydrocarbon found in waste oil, waste polymer and landfill. The resonance in angular displacement is accompanied by resonance in kinetic energy {15} as is well known in classical dynamics. The kinetic energy inputted by the $\underline{B}^{(3)}$ field becomes theoretically infinite at Euler resonance induced by the nanometric catalyst, and this always occurs when there is a free electron present. Without the $\underline{B}^{(3)}$ field there is no mechanism with which to define the driving torque with one electron.

The rest of the Kurata / B(3) process uses carefully designed nanometre catalysts in moulds to recombine the fragments dissociated by the $\underline{B}^{(3)}$ field. There are many Kurata / B(3) technologies. three pilot plants, a full sale plant and plans for several more full scale plants. The first technology to be developed into a full scale industrial plant {1} uses oil waste and olive oil waste to produce a type of diesel that burns without emissions. The plant capacity is planned to be 40,000 tonnes per annum. It is possible to use any kind of waste containing suitable hydrogen rich hydrocarbon to produce any kind of fuel, for example petroleum, kerosene, naphtha, diesel and ethanol. All these burn without harmful emissions using existing automobile engines, for example those in cars, ships and propeller aircraft. It is also possible to use the Kurata / B(3) process to produce hydrogen and oxygen from water, producing various forms of fuel from water. A similar Kurata / B(3) process has been used on a NASA space shuttle to produce clean water. This process can be used to bring clean water plants to towns and villages.

2. THE TORQUE BETWEEN $\underline{B}^{(3)}$ AND THE SPIN MAGNETIC DIPOLE MOMENT.

The spin magnetic dipole moment of an electron in an ion or paramagnetic material is defined by

$$\underline{m} = \frac{e}{m}\underline{S} = \frac{e\hbar}{2m}\underline{\sigma} \qquad -(1)$$

where e and m are the charge and mass, and $\underline{S}$ is the spin angular momentum, defined as follows by the Pauli vector $\underline{\sigma}$:

$$\underline{\sigma} = \sigma_X \underline{i} + \sigma_Y \underline{j} + \sigma_Z \underline{k} . \qquad -(2)$$

The Pauli vector is defined by:

$$\underline{\sigma} = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \underline{i} + \begin{bmatrix} 0 & -i \\ i & 0 \end{bmatrix} \underline{j} + \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \underline{k} \qquad -(3)$$

in which the three Pauli matrices are treated in a scalar like manner. The three Pauli matrices are:

$$\sigma_X = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}, \quad \sigma_Y = \begin{bmatrix} 0 & -i \\ i & 0 \end{bmatrix}, \quad \sigma_Z = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}. \qquad -(4)$$

Defining the position vector by:

$$\underline{r} = X\underline{i} + Y\underline{j} + Z\underline{k} \qquad -(5)$$

then:

$$\underline{\sigma} \cdot \underline{r} = \begin{bmatrix} Z & X - iY \\ X + iY & -Z \end{bmatrix}. \qquad -(6)$$

The torque between $\underline{m}$ and $\underline{B}^{(3)}$ is {3 - 12}:

$$\underline{Tq} = -\underline{m} \times \underline{B}^{(3)} \qquad -(7)$$

and the energy of interaction is:

$$E = -\underline{m} \cdot \underline{B}^{(3)}. \quad -(8)$$

The energy (E) gives radiatively induced fermion resonance, RFR {3 - 12}, which is high resolution ESR, NMR and MRI without magnets.

The torque magnitude is:

$$Tq = mB^{(3)} \sin\theta. \quad -(9)$$

The angle θ is considered to be defined by a characteristic angular frequency ω which must be found by experiment. It is not the angular frequency of the applied electromagnetic field because it is the result of interaction of field with material. If a torque of type (7) is used in a nanometric catalyst, the following Euler resonance equation can be constructed theoretically on the classical level:

$$\frac{d^2\theta}{dt^2} + \omega_0^2 \theta = \frac{mB^{(3)}}{I} \sin(\omega t) \quad -(10)$$

Here I is the moment of inertia of the ion or paramagnetic material containing the free electron, and ω_0

is a characteristic frequency of the catalyst. The basis of this equation is described in UFT 183 on www.aias.us. For simplicity it is constructed for planar rotational motion, so that only one angle is needed. The fundamental idea is based on the planar itinerant oscillator {16} but without the stochastic torque and friction term.

The particular solution of Eq. (10) is:

$$\theta = \frac{mB^{(3)}}{I} \left(\frac{\sin(\omega t)}{\omega_0^2 - \omega^2} \right) \quad -(11)$$

and at resonance

$$\omega = \omega_0 \qquad -(12)$$

the angular displacement and angular kinetic energy go to infinity {15}, causing dissociation by resonant amplification of the driving torque (7). This process is theoretically orders of magnitude more efficient with microwave irradiation rather than visible frequency irradiation. There are other torques present such as:

$$\underline{Tq}_1 = -\underline{m} \times \underline{B}^{(1)} \qquad -(13)$$

where the transverse $\underline{B}^{(1)}$ is defined by:

$$\underline{B}^{(1)} = \frac{B^{(0)}}{\sqrt{2}} \left(\underline{i} - i \underline{j} \right) e^{i\phi} \qquad -(14)$$

with phase:

$$\phi = \omega_1 t - \kappa Z \qquad -(15)$$

where ω_1 is the angular frequency of the electromagnetic field at instant t, and κ is its wavenumber at displacement Z along the axis of propagation.

In general the torque (14) is worked out with definition of vector cross product:

$$\underline{\sigma} \times \underline{B}^{(1)} = -\underline{i}\, \sigma_Z B_Y^{(1)} + \sigma_Z B_X^{(1)} \underline{j} + \left(\sigma_X B_Y^{(1)} - \sigma_Y B_X^{(1)} \right) \underline{k}. \qquad -(16)$$

The Z component of torque is therefore:

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} Tq_Z = \begin{bmatrix} m_X B_Y^{(1)} & i m_Y B_X^{(1)} \\ -i m_Y B_X^{(1)} & m_X B_Y^{(1)} \end{bmatrix} \qquad -(17)$$

and so there are two values, left and right circularly polarized, for a given a index (1):

$$Tq_Z = m_X B_Y^{(1)} (\text{twice}). \qquad -(18)$$

Similarly there are two types of torque about the X axis;

$$Tq_X \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = - \begin{bmatrix} m_Z B_Y^{(1)} & 0 \\ 0 & -m_Z B_Y^{(1)} \end{bmatrix} \quad -(19)$$

and two types of torque about the Y axis:

$$Tq_Y \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} m_Z B_X^{(1)} & 0 \\ 0 & -m_Z B_X^{(1)} \end{bmatrix} . \quad -(20)$$

It is argued as follows that this torque is greatly amplified by use of microwaves instead of visible frequency irradiation. Consider the Pauli Schroedinger equation:

$$\hat{H} \phi = E \phi \quad -(21)$$

where $\hat{H}$ is the hamiltonian operator, E the total energy, and ϕ the wavefunction. In the presence of a complex valued vector potential $\underline{A}$, and using the minimal prescription:

$$\hat{H} = \frac{1}{2m} \underline{\sigma} \cdot \left(\underline{p} - e\underline{A} \right) \underline{\sigma} \cdot \left(\underline{p} - e\underline{A}^* \right) + V \quad -(22)$$

where V is the potential energy. Here $\underline{A}^*$ is the complex conjugate of $\underline{A}$. Consider the following component of the hamiltonian (22), derived by use of Pauli algebra {3 - 12}:

$$\hat{H}_{IFE} = i \frac{e^2}{2m} \underline{\sigma} \cdot \underline{A} \times \underline{A}^* . \quad -(23)$$

In complex circular notation this is:

$$\hat{H}_{IFE} = i \frac{e^2}{2m} \underline{\sigma} \cdot \underline{A}^{(1)} \times \underline{A}^{(2)} . \quad -(24)$$

The $\underline{B}^{(3)}$ field is defined by {3 - 12}:

$$\underline{B}^{(3)} = \underline{B}^{(3)*} = -i\frac{e}{\hbar}\underline{A}^{(1)} \times \underline{A}^{(2)} \quad -(25)$$

so:

$$\hat{H}_{IFE} = -\frac{e\hbar}{2m}\underline{\sigma} \cdot \underline{B}^{(3)} = -\underline{m} \cdot \underline{B}^{(3)}. \quad -(26)$$

The vector potential is considered to be the plane wave:

$$\underline{A}^{(1)} = \frac{A^{(0)}}{\sqrt{2}}\left(\underline{i} - i\underline{j}\right) \exp\left(i\left(\omega_1 t - \kappa Z\right)\right) \quad -(27)$$

whose complex conjugate is:

$$\underline{A}^{(2)} = \frac{A^{(0)}}{\sqrt{2}}\left(\underline{i} + i\underline{j}\right) \exp\left(-i\left(\omega_1 t - \kappa Z\right)\right). \quad -(28)$$

The Piekara Kielich conjugate product is therefore:

$$\underline{A}^{(1)} \times \underline{A}^{(2)} = iA^{(0)2}\underline{k}. \quad -(29)$$

Therefore:

$$\hat{H}_{IFE} = -\frac{e^2}{2m}A^{(0)2}\underline{\sigma} \cdot \underline{k}. \quad -(30)$$

The power density in watts per square metre of electromagnetic radiation is:

$$I_n = \frac{c}{\mu_0}B^{(0)2} \quad -(31)$$

where μ_0 is the vacuum permeability in S. I. Units, and where $B^{(0)}$ is the magnitude of the magnetic flux density of the plane wave in S. I. Units of tesla. A method must be found to relate $A^{(0)}$ to $B^{(0)}$. One simple method is to use:

$$\underline{B}^{(1)} = \underline{\nabla} \times \underline{A}^{(1)} \quad -(32)$$

and

$$\underline{B}^{(2)} = \underline{\nabla} \times \underline{A}^{(2)} \quad -(33)$$

In a more complete development based on ECE theory, the spin connection terms and antisymmetry laws are considered. In the simple theory based on Eqs. (32) and (33):

$$\underline{B}^{(1)} = \kappa \underline{A}^{(1)} \quad -(34)$$

so

$$B^{(0)} = \kappa A^{(0)} = \frac{\omega_1}{c} A^{(0)} \quad -(35)$$

From Eqs. (31) and (35):

$$A^{(0)2} = \mu_0 c \left(\frac{I_n}{\omega_1^2}\right) \quad -(36)$$

From Eqs. (30) and (36):

$$\hat{H}_{IFE} = -\frac{e^2 \mu_0 c}{2m} \left(\frac{I_n}{\omega_1^2}\right) \underline{\sigma} \cdot \underline{k} \quad -(37)$$

the interaction hamiltonian is proportional to I_n and inversely proportional to the square of ω_1 so is orders of magnitude greater at microwave than visible frequencies for a given I_n.

The driving torque is therefore:

$$Tq = \frac{e^2 \mu_0 c}{2m} \left(\frac{I_n}{\omega_1^2}\right) |\underline{\sigma}| \sin(\omega t) \quad -(38)$$

and the angular displacement is:

$$\theta = \frac{e^2 \mu_0 c}{2mI} \left(\frac{I_n}{\omega^2}\right) |\underline{\sigma}| \frac{\sin \omega t}{\omega_0^2 - \omega^2} \quad -(39)$$

where μ_0 is the vacuum permeability. The torque is greatly amplified using microwaves and is also amplified by using pulses of high power density. At resonance:

$$\omega = \omega_0 . \qquad (40)$$

the angular displacement goes to infinity and also the angular kinetic energy, so molecular dissociation takes place. This is one of many possible Kurata / B(3) mechanisms, but the mechanism of this paper is the only one that applies to the spin magnetic dipole moment due to a free electron.

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