

# INFINITE ENERGY AND SUPERLUMINAL MOTION IN SPHERICAL SPACETIME.

by

M. W. Evans and H. Eckardt,

Civil List and AIAS / UPITEC.


([www.aias.us](http://www.aias.us), [www.upitec.org](http://www.upitec.org), [www.et3m.net](http://www.et3m.net), [www.archive.org](http://www.archive.org), [www.webarchive.org.uk](http://www.webarchive.org.uk))

## ABSTRACT

It is shown that force and potential energy are generated by the general spherical spacetime (denoted "m space") and under well defined conditions this energy is imparted to material matter. It is defined by an  $m(r)$  function that reduces to unity in Minkowski spacetime. The spin connection of ECE2 theory is shown to originate in m space, and the frame rotation theory of the spin connection is related to  $m(r)$ . Superluminal motion is generated through the generalized Lorentz factor of m space. In a well defined classical limit the latter reduces to orbit theory that shows how  $m(r)$  may be measured by routine astronomy.

Keywords: ECE2 theory in spherical spacetime, m theory, infinite energy and superluminal motion from spherical spacetime.

UFT 417



## 1. INTRODUCTION

In recent papers of this series {1 - 41} the dynamics of orbits have been developed in the most general spherically symmetric spacetime, denoted "m space". The m space is characterized by a well known infinitesimal line element containing the  $m(r)$  function, (denoted "m function" for short) where  $m$  is any function of the coordinate  $r$  of the plane polar system  $(r, \phi)$ . In section 2 it is shown that m space contains force and potential energy which may be imparted as kinetic energy to material matter. Under well defined conditions the force and potential energy of m space become infinite, and the ubiquitous m space contains an infinite amount of potential energy which is observable precisely in radiative corrections such as the Lamb shift. The m space is also responsible for the spin connection of ECE2 theory, and its generalized Lorentz factor results in superluminal motion. A method is given for the astronomical observation of the m function.

This paper is a brief synopsis of detailed calculations in the notes accompanying UFT417 on [www.aias.us](http://www.aias.us). Note 417(1) defines the force due to m space, synonymous with "vacuum force" or "aether force". Note 417(2) is a summary of the equations of motion of m space and their Minkowski limit. Note 417(3) is a preliminary version of Note 417(4) which defines the condition for the transfer of an infinite peak of potential energy from m space to kinetic energy in material matter. Note 417(5) defines the work integral of the force of m space, or "vacuum force", and gives an outline of how the force of m space can account for the Lamb shift. Note 417(6) relates the m function to the frame rotation theory of recent UFT papers, both for forward and retrograde precessions. Note 417(7) uses well known turning point theory in differential calculus to define the general maxima, minima and inflexions of the force due to m space. The energy due to m space is included in the hamiltonian and the rest energy defined in m space. The rest energy is subtracted from the hamiltonian to give the reduced hamiltonian. A well defined approximation is used to greatly simplify the calculation

of the reduced hamiltonian in the classical limit and the orbital velocity calculated in m space. This calculation gives an expression for the m function in terms of the observed orbital velocity at a point r in any orbit. The concepts and approximations used are shown to be rigorously self consistent.

In section 3, the superluminal method is demonstrated and the theory of Section 2 complemented by discussion and graphics.

## 2. INFINITE ENERGY, SUPERLUMINAL MOTION AND ORBIT DYNAMICS

Consider the plane polar coordinate system  $(r_1, \phi)$  defined by:

$$r_1 = \frac{r}{m(r)^{1/2}} \quad - (1)$$

and introduced in immediately preceding UFT papers. In this coordinate system the lagrangian of m space is:

$$\mathcal{L} = -mc^2 \left( m(r) - \frac{1}{c^2} \dot{r}_1 \cdot \dot{r}_1 \right)^{1/2} + \frac{mMg}{r_1} \quad - (2)$$

where the m function is defined by the infinitesimal line element and the Lorentz factor:

$$\gamma = \left( m(r) - \frac{1}{c^2} \dot{r}_1 \cdot \dot{r}_1 \right)^{-1/2} \quad - (3)$$

of m space. The gravitational potential energy of attraction between m orbiting M in the lagrangian ( 2 ) is:

$$U = -\frac{mMg}{r_1} \quad - (4)$$

where G is Newton's constant. The Euler Lagrange equation is:

$$\frac{d}{dt} \frac{\partial \mathcal{L}}{\partial \dot{r}_1} = \frac{\partial \mathcal{L}}{\partial r_1} = \underline{\nabla} \mathcal{L} = \frac{\partial \mathcal{L}}{\partial r_1} \underline{e}_r \quad (5)$$

in which the relativistic linear momentum of m space is:

$$\underline{p}_1 = \frac{\partial \mathcal{L}}{\partial \dot{r}_1} \quad (6)$$

The Euler Lagrange equation is therefore the orbit equation:

$$\underline{F}_1 = \frac{d\underline{p}_1}{dt} = \frac{\partial \mathcal{L}}{\partial r_1} \underline{e}_r \quad (7)$$

in which the relativistic linear momentum is:

$$\underline{p}_1 = \gamma m \dot{r}_1 = \frac{\gamma m \dot{r}}{m(r)^{1/2}} \quad (8)$$

The orbit equation ( 7 ) is the relativistic generalization in m space of the well known classical orbit equation

$$\underline{F} = \frac{d\underline{p}}{dt} = -\frac{mM\Gamma}{r^2} \underline{e}_r \quad (9)$$

In Eq. ( 7 ):

$$\frac{\partial \mathcal{L}}{\partial r_1} = -\frac{mc^2}{2} \gamma \frac{dm(r)}{dr_1} - \frac{mM\Gamma}{r_1^2} \quad (10)$$

so:

$$\underline{F}_1 = \frac{d\underline{p}_1}{dt} = \left( -\frac{mc^2}{2} \gamma \frac{dm(r)}{dr_1} - \frac{mM\Gamma}{r_1^2} \right) \underline{e}_r \quad (11)$$

and the m space produces an entirely new type of force:

$$\underline{F}(\text{vac}) = -\frac{mc^2}{2} \gamma \frac{dm(r)}{dr_1} \underline{e}_r \quad (12)$$

which does not exist in Minkowski spacetime or in classical orbit theory. This is the force due

to m space or "vacuum force" denoted  $F(\text{vac})$ . In ECE theory:

$$\underline{F}(\text{vac}) = -\underline{\Omega}_r \Phi \quad - (13)$$

where  $\Phi$  is the gravitational potential and  $\underline{\Omega}_r$  the radial spin connection vector:

$$\underline{\Omega}_r = \Omega_r \underline{e}_r \quad - (14)$$

Therefore:

$$\underline{F}(\text{vac}) = \underline{\Omega}_r \Phi = -\frac{mc^2}{2} \gamma \frac{dm(r)}{dr} \underline{e}_r \quad - (15)$$

In this equation:

$$\frac{dm(r)}{dr} = \frac{dm(r)}{dr} \frac{dr}{dr} \quad - (16)$$

Therefore using computer algebra, the force due to m space, synonymous with vacuum force,

is:

$$\underline{F}(\text{vac}) = \frac{\gamma mc^2 m(r)^{3/2} \frac{dm(r)}{dr} \underline{e}_r}{r \frac{dm(r)}{dr} - 2m(r)} \quad - (17)$$

It becomes infinite at the point:

$$r \frac{dm(r)}{dr} = 2m(r) \quad - (18)$$

form which the m function for infinite transfer of energy may be found. This is graphed in

Section 3.

The equations of motion of the orbit in m space are:

$$\frac{dH}{dt} = 0 \quad - (19)$$

and

$$\frac{dL}{dt} = 0 \quad - (20)$$

In the usual  $(r, \phi)$  plane polar coordinate system the hamiltonian is:

$$H = \gamma m c^2 m(r) - m(r) \frac{M G}{r} \quad - (21)$$

and the angular momentum is:

$$L = \frac{\gamma m r^2 \dot{\phi}}{m(r)} \quad - (22)$$

The orbit equations are those of conservation of the m space hamiltonian and angular momentum. In these equations the Lorentz factor of m space is:

$$\gamma = \left( m(r) - \frac{v^2}{m(r)c^2} \right)^{-1/2} \quad - (23)$$

In the immediately preceding UFT papers it was demonstrated numerically that the orbit equations of m space rigorously conserve H and L. The theory and computation therefore pass this severe and rigorous test of correctness.

By computer algebra the orbit equations of m space are:

$$\begin{aligned} \ddot{r} - r \dot{\phi}^2 &= \frac{dm(r)}{dr} \left( c^2 m(r) + \frac{M G}{2\gamma^3 r m(r)^{1/2}} - \frac{3c^2}{2\gamma^2} \right) \\ &- \frac{1}{m(r)} \frac{dm(r)}{dr} \dot{\phi}^2 r^2 \left( 2 - \frac{M G}{2\gamma c^2 m(r)^{1/2}} \right) \\ &- M G \left( \frac{m(r)^{1/2}}{\gamma^3 c^2} + \frac{\dot{\phi}^2}{\gamma c^2 m(r)^{1/2}} \right) \quad - (24) \end{aligned}$$

and

$$\begin{aligned} r \ddot{\phi} + 2\dot{\phi} \dot{r} &= r \dot{\phi} \dot{r} \left( \frac{1}{m(r)} \frac{dm(r)}{dr} \left( 2 - \frac{M G}{2\gamma c^2 r m(r)^{1/2}} \right) \right. \\ &\left. + \frac{M G}{2\gamma^3 c^2 m(r)^{1/2}} \right) \quad - (25) \end{aligned}$$

In the preceding paper these were integrated numerically to give any observable orbit in terms of any function  $m$ . This procedure goes considerably beyond the standard model, in which  $m$  is restricted to:

$$m(r) = 1 - \frac{2mG}{c^2 r} \quad - (26)$$

by the incorrect Einstein field equation. The  $m$  theory of this paper gives startlingly original results such as infinite vacuum energy and superluminal motion and retrograde orbits observable in the newly discovered S2 star {1 - 41}. The incorrect Einstein field equation is wholly incapable of giving any of these results.

In the Minkowski limit (Note 417(2)), Eqs. ( 24 ) and ( 25 ) reduce to:

$$\ddot{r} - r \dot{\phi}^2 = -\frac{mG}{\gamma} \left( \frac{1}{\gamma^2 r^2} - \frac{\dot{\phi}^2}{c^2} \right) \quad - (27)$$

and

$$2\dot{\phi}\dot{r} + r\ddot{\phi} = mG \left( \frac{\dot{\phi}\dot{r}}{\gamma c^2 r} \right) \quad - (28)$$

given in an earlier UFT paper. In the limit:

$$\gamma \rightarrow 1, \quad c \rightarrow \infty \quad - (29)$$

Eqs. ( 27 ) and ( 28 ) reduce to the classical orbit equations:

$$\ddot{r} - r \dot{\phi}^2 = -\frac{mG}{r^2} \quad - (30)$$

and

$$2\dot{\phi}\dot{r} + r\ddot{\phi} = 0. \quad - (31)$$

Eq. ( 30 ) is the Leibniz equation and Eq. ( 31 ) is equivalent to the conservation of

classical angular momentum:

$$\frac{dL}{dt} = \frac{d}{dt} (m r^2 \dot{\phi}) = 0. \quad - (32)$$

Consider the force generated by m space (or vacuum force):

$$\underline{F}(\text{vac}) = \left( \frac{\gamma m c^2 m(r)^{3/2}}{r \frac{dm(r)}{dr} - 2m(r)} \right) \frac{dm(r)}{dr} \underline{e}_r. \quad - (33)$$

The work done by this force is:

$$W_{12} = \int_1^2 \underline{F}(\text{vac}) \cdot d\underline{r} = T_2 - T_1 = U_1 - U_2 \quad - (34)$$

where  $T_2 - T_1$  is the change in kinetic energy and  $U_1 - U_2$  is the change in potential energy. The hamiltonian is conserved:

$$H = T_1 + U_1 = T_2 + U_2 \quad - (35)$$

so:

$$U_1 - U_2 = T_2 - T_1. \quad - (36)$$

The potential energy equation:

$$U_1 - U_2 = \int \underline{F} \cdot d\underline{r} \quad - (37)$$

is satisfied by:

$$\underline{F} = -\underline{\nabla} U \quad - (38)$$

so the potential energy of m space is:



$$\bar{U}(\text{vac}) = - \int \frac{\gamma m c^2 m(r)^{3/2}}{r \frac{dm(r)}{dr} - 2m(r)} \frac{dm(r)}{dr} dr \quad (39)$$

and the energy becomes infinite under the condition ( 18 ). The potential energy (39) imparts the kinetic energy:

$$T(\text{vac}) = -\bar{U}(\text{vac}) \quad (40)$$

to material matter. This is denoted "energy from m space" or energy from spacetime.

This energy reveals itself in the radiative corrections for example and can be trapped in a circuit as described in UFT311, UFT321, UFT364, UFT382 and UFT383. In a thought experiment it is possible to consider the Coulomb law in m space as follows:

$$\bar{F} = \frac{dp}{dt} = - \frac{e^2 m(r)^{1/2}}{4\pi \epsilon_0 r} \underline{e}_r \quad (41)$$

where the relativistic momentum in m space is:

$$\underline{p} = \frac{\gamma m \underline{\dot{r}}}{m(r)^{1/2}} \quad (42)$$

and the Lorentz factor in m space is:

$$\gamma = \left( m(r) - \frac{v^2}{m(r)c^2} \right)^{-1/2} \quad (43)$$

In Section 3 it is shown that the Lorentz factor in m space gives superluminal motion, opening up the possibility of superluminal motion between planets of the solar system, and between stars known to have planets. The vacuum force on one electron is given by Eq.

( 33 ). In immediately preceding UFT papers we have considered this vacuum force in terms of shivering and zitterbewegung as in Lamb shift theory. Isotropic averages of zitterbewegung

as in Lamb shift theory can be now be developed in terms of the force ( 33 ).

The m function is defined by the well known infinitesimal line element of the most general spherically symmetric spacetime:

$$ds^2 = c^2 d\tau^2 = m(r) c^2 dt^2 - \frac{dr^2}{m(r)} - r^2 d\phi^2 \quad (44)$$

in plane polar coordinates (  $r, \phi$  ). In m space, the m function is not constrained by the incorrect Einstein field equation. This property introduces large number of possibilities in cosmology.

There is nothing equivalent to m force in Minkowski spacetime, whose lagrangian

is:

$$\begin{aligned} \mathcal{L} &= -mc^2 \left( 1 - \frac{v^2}{c^2} \right)^{1/2} - \bar{U} \\ &= -mc^2 \left( 1 - \frac{1}{2} \frac{v^2}{c^2} + \dots \right) - \bar{U} \sim \frac{1}{2} mv^2 - mc^2 - \bar{U} \\ &= \mathcal{L}_c - mc^2 \quad (45) \end{aligned}$$

where the classical lagrangian is:

$$\mathcal{L}_c = \frac{1}{2} mv^2 - \bar{U}. \quad (46)$$

In the m space the lagrangian is:

$$\begin{aligned} \mathcal{L} &= -mc^2 \left( m(r) - \frac{v^2}{m(r)c^2} \right)^{1/2} - \bar{U} \quad (47) \\ &= -mc^2 m(r)^{1/2} \left( 1 - \frac{1}{2} \left( \frac{v}{m(r)c} \right)^2 + \dots \right) - \bar{U} \\ &\sim \frac{1}{2} \frac{mv^2}{m(r)^{3/2}} - m(r)^{1/2} mc^2 - \bar{U} \end{aligned}$$

So the rest energy in m space is:

$$E_0 = m(r)^{1/2} mc^2 \quad (48)$$

and the classical kinetic energy in m space is:

$$T = \frac{1}{2} \frac{m v^2}{m(r)^{3/2}} \quad - (49)$$

The infinitesimal line element of m space, Eq. (44), is the origin of the frame rotation due to underlying spacetime torsion:

$$ds^2 = c^2 d\tau^2 = c^2 dt^2 - dr^2 - r^2 d\phi'^2 \quad - (50)$$

where:

$$d\phi' = d\phi + \omega dt \quad - (51)$$

and  $\omega$  is the angular velocity of the frame rotation. As shown in Note 410(7) the newly discovered retrograde precession of the S2 star is explained by:

$$d\phi' = d\phi - \omega dt \quad - (52)$$

but has no explanation in the Einstein field equation. In these equations the orbital linear velocity of frame rotation is:

$$v_\phi = \omega r \quad - (53)$$

where:

$$\omega = \frac{d\phi}{dt} \quad - (54)$$

As shown in Note 417(6), forward precession is described by:

$$ds^2 = (c^2 - 3v_\phi^2) dt^2 - dr^2 - r^2 d\phi^2 \quad - (55)$$

and retrograde precession by:

$$ds^2 = (c^2 + v\dot{\phi}^2) dt^2 - dr^2 - r^2 d\phi^2 \quad - (56)$$

For forward precession in the classical limit, the orbit is:

$$r = \frac{d}{1 + \epsilon \cos(\phi + \omega t)} \quad - (57)$$

with precession:

$$\Delta\phi = \omega T \quad - (58)$$

where T is the time needed to complete one orbit.

For retrograde precession the orbit is:

$$r = \frac{d}{1 + \epsilon \cos(\phi - \omega t)} \quad - (59)$$

and the precession is:

$$\Delta\phi = -\omega T \quad - (60)$$

This equation explains the retrograde precession of - 1 degree per orbit of the S2 star by using the observed T of the S2 star - about fifteen earth years and measuring  $\omega$  by observation. The result from the Einstein field equation is completely incorrect. It is + 0.2 degrees per orbit of the S2 star.

Comparing Eqs. (44) and (55):

$$3\frac{v\dot{\phi}^2}{c^2} = 1 - m(r) + \frac{1}{c^2} \left( \frac{1}{m(r)} - 1 \right) \left( \frac{dr}{dt} \right)^2 \quad - (61)$$

and m ( r ) can be found by computer algebra. It is discussed and graphed in Section 3. If:

$$\frac{dr}{dt} \ll c \quad - (62)$$

then

$$m(r) \sim 1 - 3 \frac{v \phi^2}{c^2} \quad - (63)$$

Similarly for retrograde precession:

$$m(r) \sim 1 + \frac{v \phi^2}{c^2} \quad - (64)$$

By expanding the Lorentz factor of m space:

$$\gamma = \left( m(r) - \frac{v^2}{m(r)c^2} \right)^{-1/2} = m(r)^{1/2} \left( 1 - \left( \frac{v}{m(r)c} \right)^2 \right)^{-1/2} \quad - (65)$$

it follows that the hamiltonian ( 21 ) of m space can be developed as:

$$H = m(r)^{1/2} \left[ \left( 1 - \left( \frac{v}{m(r)c} \right)^2 \right)^{-1/2} mc^2 - \frac{mMG}{r} \right] \quad - (66)$$

as in Note 417(7). In the classical limit:

$$H \sim m(r)^{1/2} \left[ \left( 1 + \frac{1}{2} \frac{v^2}{m^2(r)c^2} \right) mc^2 - \frac{mMG}{r} \right] \quad - (67)$$

Now subtract the rest energy ( 48 ) from the hamiltonian to give the reduced hamiltonian:

$$H_0 = H - m(r)^{1/2} mc^2 \quad - (68)$$

In the  $(r, \phi)$  coordinate system:

$$H_0 = \frac{1}{2} m \frac{(r^2 + r^2 \dot{\phi}^2)}{m(r)^{3/2}} - m(r)^{1/2} \frac{mMG}{r} \quad - (69)$$

The angular momentum in m space is:

$$L = \frac{\gamma m r^2 \dot{\phi}}{m(r)} \quad - (70)$$

so the reduced hamiltonian is:

$$H_0 = \frac{1}{2} \frac{m \dot{r}^2}{m(r)^{3/2}} + \frac{1}{2} m(r)^{1/2} \frac{L^2}{\gamma^2 m r^2} - m(r)^{1/2} \frac{m M G}{r} \quad - (71)$$

Now use the approximation:

$$\frac{1}{\gamma^2} = m(r) - \frac{v^2}{m(r)c^2} \xrightarrow{v \ll c} m(r) \quad - (72)$$

in the classical limit:

$$v \ll c \quad - (73)$$

to give the reduced hamiltonian:

$$H_0 \sim \frac{1}{2} \frac{m \dot{r}^2}{m(r)^{3/2}} + \frac{1}{2} m(r)^{3/2} \frac{L^2}{m r^2} - m(r)^{1/2} \frac{m M G}{r} \quad - (74)$$

In the limit:

$$m(r) \rightarrow 1 \quad - (75)$$

this reduces to the well known classical result:

$$H_0 = \frac{1}{2} m \dot{r}^2 + \frac{1}{2} \frac{L^2}{m r^2} - \frac{m M G}{r} \quad - (76)$$

which gives the static conic section

$$r = \frac{d}{1 + \epsilon \cos \phi} \quad - (77)$$

The approximation ( 72 ) considerably simplifies the calculation, because  $\gamma^2$  in the original equation ( 71 ) contains  $v$ , and in the approximate expression ( 74 ) does not contain  $v$ .

From Eq. ( 74 ):

$$\left(\frac{dr}{dt}\right)^2 = \frac{2m(r)^{3/2}}{m} \left( H_0 - \frac{1}{2} m(r)^{3/2} \frac{L^2}{mr^2} + m(r)^{1/2} \frac{mMG}{r} \right) \quad - (78)$$

which in the classical limit becomes:

$$\left(\frac{dr}{dt}\right)^2 \xrightarrow{m(r) \rightarrow 1} \frac{2}{m} \left( H_0 - \frac{1}{2} \frac{L^2}{mr^2} + \frac{mMG}{r} \right) \quad - (79)$$

The orbital velocity in m space is therefore given by:

$$\begin{aligned} v^2 &= \left(\frac{dr}{dt}\right)^2 + r^2 \left(\frac{d\phi}{dt}\right)^2 \quad - (80) \\ &= \left(\frac{dr}{dt}\right)^2 + \frac{m(r)^2 L^2}{r^2 m^2 r^2} \sim \left(\frac{dr}{dt}\right)^2 + \frac{m(r)^3 L^2}{m^2 r^2} \end{aligned}$$

in the classical limit ( 72 ). Therefore the orbital velocity in m space is, in approximation

( 72 ):

$$v^2 = \frac{2m(r)^{3/2}}{m} \left( H_0 + m(r)^{1/2} \frac{mMG}{r} \right) \quad - (81)$$

From Eq. ( 69 ):

$$H_0 = \frac{1}{2} \frac{mv^2}{m(r)^{3/2}} - m(r)^{1/2} \frac{mMG}{r} \quad - (82)$$

so using Eq. ( 82 ) in ( 81 ) gives:

$$H_0 = H_0 + m(r)^{1/2} \left( \frac{mMG}{r} - \frac{mMG}{r} \right) \quad - (83)$$

This shows that Eqs. ( 81 ) and ( 82 ) are self consistent, Q. E. D.

For small departures from Newtonian theory:

$$H_0 \sim -\frac{mM_G}{2a} \quad - (84)$$

where  $a$  is the semi major axis of the orbit. So

$$v^2 = m(r)^{3/2} M_G \left( \frac{2m(r)^{1/2}}{r} - \frac{1}{a} \right) \quad - (85)$$

In the limit:

$$m(r) \rightarrow 1 \quad - (86)$$

this correctly reduces to the well known Newtonian result:

$$v^2 = M_G \left( \frac{2}{r} - \frac{1}{a} \right) \quad - (87)$$

Q. E. D. Eq. ( 85 ) gives a method of measuring the  $m$  function from observations of  $v$  and  $r$  in any orbit. Eq. ( 85 ) gives the quartic equation:

$$2ax^4 - rx^3 = \frac{v^2 ra}{M_G} \quad - (88)$$

where:

$$x = m(r)^{1/2} \quad - (89)$$

This is solved for the four roots in Section 3, and the results graphed. Note that Eq. ( 88 ) is true for any orbit within the approximations used.

### 3. SUPERLUMINAL MOTION, GRAPHICS AND DISCUSSION.

Section by dr. Horst Eckardt.



## ACKNOWLEDGMENTS

The British Government is thanked for a Civil List Pension and the staff of AIAS and others for many interesting discussions. Dave Burleigh, CEO of Annexa Inc., is thanked for voluntary posting, site maintenance and feedback maintenance. Alex Hill is thanked for many translations, and Robert Cheshire and Michael Jackson for broadcasting and video preparation.

## REFERENCES

- {1} M. W. Evans, H. Eckardt, D. W. Lindstrom, D. J. Crothers and U. E. Bruchholtz. "Principles of ECE Theory, Volume Two" (ePubli, Berlin 2017).
- {2} M. W. Evans, H. Eckardt, D. W. Lindstrom and S. J. Crothers, "Principles of ECE Theory, Volume One" (New Generation, London 2016, ePubli Berlin 2017).
- {3} M. W. Evans, S. J. Crothers, H. Eckardt and K. Pendergast, "Criticisms of the Einstein Field Equation" (UFT301 on [www.aias.us](http://www.aias.us) and Cambridge International 2010).
- {4} M. W. Evans, H. Eckardt and D. W. Lindstrom "Generally Covariant Unified Field Theory" (Abramis 2005 - 2011, in seven volumes softback, open access in various UFT papers, combined sites [www.aias.us](http://www.aias.us) and [www.upitec.org](http://www.upitec.org)).
- {5} L. Felker, "The Evans Equations of Unified Field Theory" (Abramis 2007, open access as UFT302, Spanish translation by Alex Hill).
- {6} H. Eckardt, "The ECE Engineering Model" (Open access as UFT203, collected equations).
- {7} M. W. Evans, "Collected Scientometrics" (open access as UFT307, New Generation, London, 2015).
- {8} M. W. Evans and L. B. Crowell. "Classical and Quantum Electrodynamics and the B(3) Field" (World Scientific 2001, open access in the Omnia Opera section of [www.aias.us](http://www.aias.us)).

{9} M. W. Evans and S. Kielich, Eds., "Modern Nonlinear Optics" (Wiley Interscience, New York, 1992, 1993, 1997 and 2001) in two editions and six volumes, hardback, softback and e book.

{10} M. W. Evans and J. - P. Vigiér, "The Enigmatic Photon" (Kluwer, Dordrecht, 1994 to 1999) in five volumes hardback and five volumes softback, open source in the Omnia Opera Section of [www.aias.us](http://www.aias.us)).

{11} M. W. Evans, Ed. "Definitive Refutations of the Einsteinian General Relativity" (Cambridge International Science Publishing, 2012, open access on combined sites).

{12} M. W. Evans, Ed., J. Foundations of Physics and Chemistry (Cambridge International Science Publishing).

{13} M. W. Evans and A. A. Hasanein, "The Photomagnetron in Quantum Field Theory (World Scientific 1974).

{14} G. W. Robinson, S. Singh, S. B. Zhu and M. W. Evans, "Water in Biology, Chemistry and Physics" (World Scientific 1996).

{15} W. T. Coffey, M. W. Evans, and P. Grigolini, "Molecular Diffusion and Spectra" (Wiley Interscience 1984).

{16} M. W. Evans, G. J. Evans, W. T. Coffey and P. Grigolini", "Molecular Dynamics and the Theory of Broad Band Spectroscopy (Wiley Interscience 1982).

{17} M. W. Evans, "The Elementary Static Magnetic Field of the Photon", Physica B. 182(3), 227-236 (1992).

{18} M. W. Evans, "The Photon's Magnetic Field: Optical NMR Spectroscopy" (World Scientific 1993).

{19} M. W. Evans, "On the Experimental Measurement of the Photon's Fundamental Static Magnetic Field Operator,  $B(3)$ : the Optical Zeeman Effect in Atoms", Physica B. 182(3), 237 - 143 (1982).

- {20} M. W. Evans, "Molecular Dynamics Simulation of Induced Anisotropy: I Equilibrium Properties" . J. Chem. Phys., 76, 5473 - 5479 (1982).
- {21} M. W. Evans. "A Generally Covariant Wave Equation for Grand Unified Theory" Found. Phys. Lett., 16, 513 - 547 (2003).
- {22} M. W. Evans, P. Grigolini and P. Pastori-Parravicini, Eds., "Memory Function Approaches to Stochastic Problems in Condensed Matter" (Wiley Interscience, reprinted 2009).
- {23} M. W. Evans, "New Phenomenon of the Molecular Liquid State: Interaction of Rotation and Translation". Phys. Rev. Lett., 50, 371, (1983).
- {24} M. W. Evans. "Optical Phase Conjugation in Nuclear Magnetic Resonance: Laser NMR Spectroscopy", J. Phys. Chem., 95, 2256-2260 (1991).
- {25} M. W. Evans, "New Field induced Axial and Circular Birefringence Effects" Phys. Rev. Lett., 64, 2909 (1990).
- {26} M. W. Evans, J. - P. Vigi er, S. Roy and S. Jeffers, "Non Abelian Electrodynamics". "Enigmatic Photon Volume 5" (Kluwer, 1999)
- {27} M. W. Evans, reply to L. D. Barron "Charge Conjugation and the Non Existence of the Photon's Static Magnetic Field" , Physica B, 190, 310-313 (1993).
- {28} M. W. Evans, "A Generally Covariant Field Equation for Gravitation and Electromagnetism" Found. Phys. Lett., 16, 369 - 378 (2003).
- {29} M. W. Evans and D. M. Heyes, "Combined Shear and Elongational Flow by Non Equilibrium Electrodynamics", Mol. Phys., 69, 241 - 263 (1988).
- {30} Ref. (22), 1985 printing.
- {31} M. W. Evans and D. M. Heyes, "Correlation Functions in Couette Flow from Group Theory and Molecular Dynamics", Mol. Phys., 65, 1441.- 1453 (1988).
- {32} M. W. Evans, M. Davies and I. Larkin, Molecular Motion and Molecular Interaction in

the Nematic and Isotropic Phases of a Liquid Crystal Compound", J. Chem. Soc. Faraday II, 69, 1011-1022 (1973).

{33} M. W. Evans and H. Eckardt, "Spin Connection Resonance in Magnetic Motors", Physica B., 400, 175 - 179 (2007).

{34} M. W. Evans, "Three Principles of Group Theoretical Statistical Mechanics", Phys. Lett. A, 134, 409 - 412 (1989).

{35} M. W. Evans, "On the Symmetry and Molecular Dynamical Origin of Magneto Chiral Dichroism: "Spin Chiral Dichroism in Absolute Asymmetric Synthesis" Chem. Phys. Lett., 152, 33 - 38 (1988).

{36} M. W. Evans, "Spin Connection Resonance in Gravitational General Relativity", Acta Physica Polonica, 38, 2211 (2007).

{37} M. W. Evans, "Computer Simulation of Liquid Anisotropy, III. Dispersion of the Induced Birefringence with a Strong Alternating Field", J. Chem. Phys., 77, 4632-4635 (1982).

{38} M. W. Evans, "The Objective Laws of Classical Electrodynamics, the Effect of Gravitation on Electromagnetism" J. New Energy Special Issue (2006).

{39} M. W. Evans, G. C. Lie and E. Clementi, "Molecular Dynamics Simulation of Water from 10 K to 1273 K", J. Chem. Phys., 88, 5157 (1988).

{40} M. W. Evans, "The Interaction of Three Fields in ECE Theory: the Inverse Faraday Effect" Physica B, 403, 517 (2008).

{41} M. W. Evans, "Principles of Group Theoretical Statistical Mechanics", Phys. Rev., 39, 6041 (1989).