HOW AN ARTIFICIAL KERR-NEWMAN BLACK HOLE CAN RELEASE GRAVITATIONAL WAVES

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Abstract

. *We initiate a model of an artificially induced Kerr-Newman black Holes, with specific angular momentum J, and then from there model was to what would happen as to an effective charge, Q, creating an E and B field, commensurate with the release of GWs. The idea is that using a frame of reference trick, plus E + i B = - function of the derivative of a complex valued scalar field, as given by Appell, in 1887, and reviewed by Whittaker and Watson, 1927 of their "A Course of Modern Analysis" tome that a first principle identification of a B field, commensurate with increase of thermal temperature, T, so as to have artificially induced GW production. This is compared in part with the Park 1955 paper of a spinning rod, producing GW, with the proviso that both the spinning rod paper, and this artificial Kerr-Newman Black hole will employ the idea of lasers in implementation of their respective GW radiation. The idea is in part partly similar to an idea the author discussed with Dr. Robert Baker, in 2016 with the difference that a B field would be generated and linked to effects linked with induced spin to the Kerr - Newman Black hole.*

Keywords: Kerr Newman black hole, high-frequency gravitational waves (HGW), causal discontinuity.

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**** <u>My apologies for doing it, but over 24 pages of the paper, including ALL the references were removed, plus over half of the discussion. Interested readers can obtain the original document by e mailing rwill9955b@gmail.com</u> ****

I. INTRODUCTION

Our initial statement of this document is to use a Kerr- Newman black hole event horizon, with a charge, Q, and a constant angular momentum J, as an induced state of affairs which will be then utilized, if fed by laser induced energy, for the generation of gravitational waves and gravitons.

II A brief recap as to Kerr – Newman black hole physics

[40] has a complete derivation of how the Lens and Thirring studied the derivation of how a spinning sphere of uniform density created a gravitational field, on page 257 of [40] which leads to a metric

$$dS^2 = \left(1 - \frac{2m}{r}\right)\cdot c^2 \cdot dt^2 - \left(1 + \frac{2m}{r}\right)\cdot d\sigma^2 + \frac{4\kappa J}{c^2 r}\cdot\left(\sin^2\theta\right)\cdot d\varphi \cdot c \cdot dt$$

$$r \equiv \sqrt{x^2 + y^2 + z^2}$$

$$J = angular - momentum - of - sources$$

$$d\sigma^2 = flat - space - line - element - 3Dim$$

$$Lens - Thirring, iff \quad J = -c^3 m \frac{a}{\kappa} \tag{1}$$

$$and \quad set \quad r \equiv \rho$$

$$\Leftrightarrow dS^2 = \left(1 - \frac{2m}{\rho}\right)\cdot c^2 \cdot dt^2 - \left(1 + \frac{2m}{\rho}\right)\cdot d\sigma^2 - \frac{4ma}{c^2 \rho}\cdot\left(\sin^2\theta\right)\cdot d\varphi \cdot c \cdot dt$$

$$This - gives - us - rotating - Kerr$$

In our consideration, in order to simplify matters, we set J equal to a constant, i.e. this was for ease of calculation and it lead to, with the caveat of , if a is a measure of the angular momentum per mass, and if m, in Eq. (1) is mass, we can say that m is the “geometric mass” which can lead, to, as given in [40], page 260 with a Coriolis like force given by

$$\rho\ddot{\varphi} + \left(\frac{-2ma}{\rho^{3}} \right) \cdot \dot{\rho} = 0 \tag{2}$$

If we identify ρ replacing the angular velocity ω, the above is the Coriolis force, as given in page 130 of [40] this will in part, if we add a charge, Q into this business, lead to what is given in [41]

$$\begin{aligned}
dS^2 &= \frac{\tilde{\rho}^2}{c^2}\left(-\frac{dr^2}{\Delta} + d\theta^2 \right) - \frac{\Delta}{\tilde{\rho}^2}\left(c \cdot dt - \tilde{a} \cdot \left(\sin^2\theta \right) \cdot d\varphi^2 \right) \\
&- \frac{\left(\sin^2\theta \right)}{\tilde{\rho}^2} \cdot \left(c \cdot dt - \tilde{a} \cdot \left(\sin^2\theta \right) \cdot d\varphi^2 \right) \\
\tilde{a} &= J / m \cdot c \\
\Delta &= r^2 - r_S r + \tilde{a}^2 + r_Q^2 \\
\tilde{\rho}^2 &= r^2 + \tilde{a}^2 \cdot \cos^2\theta \\
r_S &= \frac{2Gm}{c^2} \\
r_Q^2 &= \frac{Q^2 G}{4\pi\varepsilon_0 c^4}
\end{aligned} \tag{3}$$

We will for the sake of simplicity approximate J as a constant when we do our calculations.

II. What we obtain by using a charge Q in a rotating black hole solution.

Reference [42] gives an extremal condition as to the mass of a Kerr Newman black hole, being bounded below, by angular momentum

J, and charge, Q. As given on page 12, of [42] we have that if we have a mass m, redefined, as the Christodoulou-Ruffini mass we could set as M by [43] will show the following set of inequalities made equalities. i.e.

$$\begin{aligned}
&\mathrm{M} = m \\
&S = S_{ext} \\
&J = J_{ext} \\
&Then \\
&S = S_{ext} = \pi \cdot \sqrt{Q_{ext}^4 + 4J_{ext}^2} \equiv \pi \cdot \sqrt{Q^4 + 4J^2} \\
&\& \\
&\mathrm{M}^2 = m^2 = \frac{1}{2} \cdot \left(Q^2 + \sqrt{Q^4 + 4J^2} \right)
\end{aligned} \tag{4}$$

The last two parts of Eq.(4) can be interpreted using the ideas of Infinite quantum statistics, as a way of making a linkage between entropy, and the counting of numbers of emitted particles, using the relationship given in [4], and [5] of

$$S = S_{ext} \approx n\left(partile - count \right) \tag{5}$$

We then, can, using Eq. (4) and Eq. (5) make the following statement as to number of stimulated particles, from a laser hitting an artificial black hole, which we will in this first reading equate with Gravitons (massive) and the matter-energy input into the artificial black hole, i.e.

$$
\begin{aligned}
&If \\
&\mathrm{M} = m \\
&S = S_{ext} \approx n \equiv \left(partile - count \right) \\
&Then \\
&S = S_{ext} \approx c_1 n \propto \left(partile - count \right) \propto \pi \cdot \sqrt{Q^4 + 4J^2} \\
&\& \\
&E_{ext} = \frac{k_B}{2} \cdot T_{applied} \approx M \cdot c^2 \\
&\Leftrightarrow \left(\frac{k_B}{2c^2} \cdot T_{applied} \right)^2 = \frac{1}{2} \cdot \left(Q^2 + \frac{c_1 n}{\pi} \right) \\
&\Rightarrow Q^2 = 2 \cdot \left(\frac{k_B}{2c^2} \cdot T_{applied} \right)^2 + \frac{c_1 n}{\pi}
\end{aligned} \tag{6}
$$

The particle count, i.e. in this case, stimulated graviton emission from the black hole, and the temperature, $T_{applied}$ from a laser smashing into a target, will influence an effective charge, Q .

III. Calculation of Electric and Magnetic fields, for the Kerr-Newman black hole, and how one can pick a frame of reference, where the E field vanishes

We begin our statement as to looking first at [44], which has a dipole approximation as to a Kerr – Newman black hole, if a charge Q is specified. Then we have a dipole approximation of the following electric field, with n, a count of particles per unit area radiated from the artificial Kerr-Newman black hole.

$$\vec{E} = \left(Electric - field \simeq \frac{Q}{r^2} \cdot \hat{e}_r \right)$$

$$Q = \sqrt{2 \cdot \left(\frac{k_B}{2c^2} \cdot T_{applied} \right)^2 + \frac{c_1 n}{\pi}} \qquad (7)$$

What we will do, assuming this base, for the electric field, is to go to [10] where we will have the following electric and magnetic field coupling to consider, namely if we have a potential given by quantity omega in this last equation is similar to the Coulomb potential, except that the radius vector is shifted by an imaginary amount which could lead to the magnetic field given by the following representation.

$$\vec{E} + i\vec{B} = -\vec{\nabla} \cdot \tilde{\Omega} = -\vec{\nabla} \cdot \frac{Q}{\sqrt{\left(\vec{r} - i \frac{\vec{J}}{m \cdot c} \right)^2}}$$

$$\vec{B} = -i\vec{E} + i \left(\vec{\nabla} \cdot \frac{Q}{\sqrt{\left(\vec{r} - i \frac{\vec{J}}{m \cdot c} \right)^2}} \right) \qquad (8)$$

The approximation which will be used here, is that J is spatially almost invariant (initially) but that it has a distinct function in time, i.e. J=J(t) i.e., we would be looking at how to have a way to make the following identification which could simply matters, first noting that there is, in this situation a B field which is given as in [44] as being approximately real valued with the far distance value of

$$\vec{B} = \frac{Q\left(\frac{J}{m \cdot c}\right)}{r^3} \cdot \left(2 \cdot (\cos\theta)\hat{e}_r + (\sin\theta)\hat{e}_\theta\right) \quad (9)$$

If we apply the 2nd part of Eq. (8) above, with respect to finding an imaginary part of the B field to be cancelled out, we can write that if we apply Eq. (7), Eq. (8) and Eq. (9) we have if we look at

$$\theta = 0 \Rightarrow \vec{B} = \frac{Q\left(\frac{J}{m \cdot c}\right)}{r^3} \cdot \left(2 \cdot \hat{e}_r\right)$$

$$and$$

$$\vec{E} = \left(Electric - field \simeq \frac{Q}{r^2} \cdot \hat{e}_r \right) \quad (10)$$

This is a case where one is having at theta = 0, both E and B fields, but we can simplify further by muse of

Then,

$$E + iB = \frac{\left[-Q \cdot (r^2 - \left(J / mc \right)^2) + Q \cdot \left(2irJ / mc \right) \right]}{\left[\left((r^2 - \left(J / mc \right)^2 \right)^2 + \left(rJ / mc \right)^2 \right]}$$

becomes

$$iB = \frac{\left[+Q \cdot \left(2irJ / mc \right) \right]}{\left[+\left(rJ / mc \right)^2 \right]} \Rightarrow B = +2Q / \left(rJ / mc \right); E = 0 \quad (11)$$

$$iff \quad r^2 = \left(J / mc \right)^2$$

i.e. we have a vanishing E field in this situation , with a B field with J = J(t), allowing for Torque, which shows up all the time in black hole physics, but we do not have much spatial variation of J, the above should be seen as a first order approximation but it is revealing, at the same time, as one is then specifying an axis of rotation in the space-time continuum which contains the artificial, induced Kerr- Newman black hole

IV. Specifying conditions for the Production of Gravitons, from the Artificial Kerr – Newman Black hole

We can consider working with the induced Kerr-Newman black hole assuming that there is a stimulated emission of particles from the artificial black hole assuming that there is a method of input from lasers, or possibly thermonuclear fusion for input into the formula we will write as

$$Q = \sqrt{2 \cdot \left(\frac{k_B}{2c^2} \cdot T_{applied} \right)^2 + \frac{c_1 n}{\pi}}$$

$$E_{ext} = \frac{k_B}{2} \cdot T_{applied} \tag{12}$$

We will be examining what would be possible input energy into this “induced Kerr- Newman “black hole.

We go back to optimizing

$$\begin{aligned}
&Q = \sqrt{2 \cdot \left(\frac{k_B}{2c^2} \cdot T_{applied} \right)^2 + \frac{c_1 n}{\pi}} \\
&E_{ext} = \frac{k_B}{2} \cdot T_{applied} \approx M \cdot c^2 \\
&2M^2 \geq Q^2 + \sqrt{Q^4 + 4J^2} \\
&\& \\
&2M^2 \geq 2 \cdot \left(\frac{k_B}{2c^2} \cdot T_{applied} \right)^2 + \frac{c_1 n}{\pi} + \sqrt{\left[2 \cdot \left(\frac{k_B}{2c^2} \cdot T_{applied} \right)^2 + \frac{c_1 n}{\pi} \right]^2 + 4J^2} \\
&\& \\
&B = +2Q / \left(rJ / mc \right)
\end{aligned} \tag{13}$$

Note that the expression of B, for magnetic field is commensurate with a specific value of r, such that we have E effectively disappear

In this case, we are assuming that, m, in the denominator of B, for when E is allegedly zero, is actually M. Going to [45] which restates the problem, to first order we are observing an equality in what is otherwise an inequality,

$$2\left(\frac{B\cdot r\cdot J}{2c\cdot\left[2\cdot\left(\frac{k_B}{2c^2}\cdot T_{applied}\right)^2+\frac{c_1 n}{\pi}\right]^{1/2}}\right)^2$$
$$\geq 2\cdot\left(\frac{k_B}{2c^2}\cdot T_{applied}\right)^2+\frac{c_1 n}{\pi}+\sqrt{\left[2\cdot\left(\frac{k_B}{2c^2}\cdot T_{applied}\right)^2+\frac{c_1 n}{\pi}\right]^2+4J^2} \quad (14)$$

In the case where the above becomes an equality, where there is an extremized value of r, we can have that we are observing a situation where a B field, which can be measured, with a value of J, for the induced Kerr – Newman metric **will lead, to a value of n, which in this case would be the number of gravitons emitted by this configured induced Kerr- Metric black hole**. And this will be assuming that the temperature $T_{applied}$ will be created by either a battery of lasers, or by possibly induced fusion.

Our next section will be a description of how to put in $T_{applied}$ into this system, and we will close with a description of an already worked out protocol for graviton/ GW detection. To do this though we first of all need to understand what allows for GW release from a Kerr- Newman black hole. This is essential, since a count of gravitons so generated and released from this Kerr-Newman black hole, is proportional to the release of information, for reasons we will specify in the next section of our paper. To do this, we consider, both

V. Comparing our work against the reference [61] results by Corda as to Effective Temperature for a black hole.

In [61] Dr. Corda did an explicit quantum physics analogy as to obtaining an effective temperature T for black holes which has many similarities as to our results. One aside, one big difference, is that our temperature $T_{applied}$ involves an applied upon by external temperature regime which we claim would induce conditions for the formation of a Kerr- Newman black hole, whereas what is done in [61] is to assume formation of a black hole leads to the effective temperature, of the black hole itself. I.e. the Corda results as of [61] involve an indigenous temperature for the black hole, which is created in the process of formation of the black hole. I.e., the [61] result does not explicitly assume creation of the black hole in question due to application of an external temperature, of the sort we did in our $T_{applied}$. Having said that, many of the results of [61] are , in part, extremely close to ours, and we can use [61] as a way to ascertain the degree of proximity to quantum processes, which is the main benefit of the analysis given in [61] by Corda.

In a word, [61] delineates a careful analysis of how much quantum process contribute to Black Hole entropy, which we also look at, and in turn is related to the temperature, T, which Corda derives in [61]

In [61] Corda delineated the effective temperature of the black hole in question as

$$T_E(\omega) \equiv \frac{1}{4\pi\left(2\tilde{M} - \omega\right)}$$

&

$\tilde{N} = \#-of\ -quanta$

$\tilde{M} \approx Black - hole - mass$

$\omega = \ frequency - emitted - radiation$

& (15)

$$S_{Total} \xrightarrow[full-quantization]{} 2\pi\tilde{N} + \left(\frac{3}{2\pi\tilde{N}} - \ln 2\pi\tilde{N}\right)$$

If so, and we assume full quantization is achieved in our model of the quantum black hole idealization we can make the following identification. i.e. to make 15 consistent with our results we can do the following, i.e. assume that n = number of gravitons is approximately the same as the number of quanta, i.e. state that we can have an overlap between the results of [61] with our results if the following block of equations is utilized? I.e. in a word, the quantity $T_E(\omega) \equiv \frac{1}{4\pi\left(2\tilde{M} - \omega\right)}$ as an effective temperature for the black hole being formed, is added as a would be definition, separate from the applied external temperature $T_{applied}$ which presumably would be put into the formed Kerr – Newman black hole. I.e. we make the following block of equations to be considered as the main result of this section of our paper.

$$T_E(\omega) \equiv \frac{1}{4\pi\left(2\tilde{M} - \omega\right)}$$

&

$\tilde{N} = \# - of - quanta$

$\tilde{M} \approx Black - hole - mass$

$\omega = frequency - emitted - radiation$

&

$$S_{Total} \xrightarrow[full-quantization]{} 2\pi\tilde{N} + \left(\frac{3}{2\pi\tilde{N}} - \ln 2\pi\tilde{N}\right) - Corda - result \quad (16)$$

$$S \xrightarrow[full-quantization]{} c_1 \cdot n - My - result$$

$Question, can - we - pick - c_1 - such - that$

$$c_1 n \equiv 2\pi\tilde{N} + \left(\frac{3}{2\pi\tilde{N}} - \ln 2\pi\tilde{N}\right), if \quad n = \tilde{N}\,?$$

If we can satisfy Eq. (16) above, we then come to a very fundamental question for our inquiry which is as follows and will be briefly mentioned as framing one of the big questions this manuscript will raise, namely

VI. What are Conditions Permitting $T_E(\omega) \equiv \frac{1}{4\pi\left(2\tilde{M} - \omega\right)} \cong T_{applied}$?

We submit that this is not a trivial question and answering it would lead to perhaps successful implementation of our idea as to forming a Kerr-Newman artificial black hole. To answer it will require well posed modeling and experimental constraint conditions which we will try to bring up in this section VIII.

First, to do this identification of theoretical value with laser $T_E(\omega) \equiv \dfrac{1}{4\pi\left(2\tilde{M} - \omega\right)} \cong T_{applied}$, we have to have the fix put in as far as Eq. (16). This is basic. Secondly, is to investigate the forwarded to inquiry as given to the author by Lawrence Crowell, August 30, 2019, namely [75]

We can create a sort of artificial black hole by recognizing that the Weyl tensor C_{abcd} defines symmetric 2-tensor components E_{ac} = g^{bd}C_{abcd} that are analogous to the electric field. That this is a rank 2 tensor means there are two polarization directions. The Hodge star or with Levi-Civita you can form the magnetic field analogue. With Bern and Dixon we have the phenomenological analogue between gravitation and gauge fields where a rank 2 tensor of this form may be formed by the entanglement of two gauge boson in a triplet state. So gluons can define a "sort of graviton" and for SU(4) --> SU(2,2) under an STU duality transformation this extended QCD has some duality with gravitation. SU(2,2) ~ SO(4,2) is the isometry group for AdS_5. It is not hard to work out the roots and weights of the SU(4), where it has an additional weight vector and 6 additional charges. Standard SU(3) QCD embeds into this theory. How SU(4) works in standard model or GUT physics is hard to know, but I think the 6 additional vector terms may form entanglements in singlet states that are the 3 Goldstone bosons of the Higgs field and the remaining weight with its anti-color field may form the left over Higgs particle h that was detected in 2012.

So in this way the heavy ion physics of the LHC with the A Large Ion Collider Experiment (ALICE) there is with the lead ions an atomic weight times the 13TeV of energy, which forms a quark-gluon plasma at considerable energy. The ALICE work is a bit of the forgotten last child in the LHC experiments, but in many ways *it is just as interesting as proton collisions. This should form something analogous to a black hole. The decay of this results in gluon pairs that should have analogues with gravitational waves.*

I.e., a mathematical investigation may, indeed yield conditions in which one can establish $T_E(\omega) \equiv \frac{1}{4\pi\left(2\tilde{M}-\omega\right)} \cong T_{applied}$.

Furthermore, is to also investigate if we can have an investigation of the strength of gravitational waves, as discussed in [13] , as given on page 505 of [13] formula for GW 'strain', namely in the case of laser light implosion, as on **page 505 of [13]**, we have h~ strain strength of GW which may be measured from an induced black hole, as given by formulas from [13] which were initially for a laser interferometer system, in LIGO, with the following comparisons., i.e. looking at

$$
\begin{aligned}
& T_E(\omega) \equiv \frac{1}{4\pi\left(2\tilde{M}-\omega\right)} \cong T_{applied} \\
& if\, \omega = \omega_{GW} \\
& \tilde{M} = 'mass-induced-black-hole \\
& \omega_{Laser-light} = frequency-of-laser \\
& W_{Laser-light} = Laser-light-power \\
& h \sim GW-strength = \left(\frac{\hbar\omega_{GW}}{4\pi\omega_{Laser-light}W_{Laser-light}}\right)^{1/2}
\end{aligned}
\tag{17}
$$

VII. What Eq. (17) portends for emitted GW(Graviton?) radiation from the Artificial Black hole

This Eq. (17) is for laser induced implosions on a black hole, Kerr-Newman style, which would in the case of the national ignition facility have an enormous power behind this, and this assumes a signal to noise ratio of about 1. Note this Eq.(17) in [13] was originally for laser interferometry in a LIGO style system, and to get what we are seeking, we are likely assuming that the laser light would be very high frequency and that we would be that both $\omega_{Laser-light}$ and ω_{GW} for frequency of emitted GW would be very high, likely in the 10^8 to 10^12 Hz range.

Furthermore as far as the size of the induced Kerr Black hole we would be looking at an induced ring singularity of at least an angstrom in 'width' i.e. likely much larger.

Our working assumption would be then that the emitted GW from the "induced black hole "would scale roughly as, if

$$
\begin{aligned}
&\omega_{GW} \approx 2\tilde{M} - \frac{1}{4\pi\left(T_{applied}\right)} \\
&if\,\omega = \omega_{GW} \\
&\tilde{M} = 'mass-induced-black-hole
\end{aligned}
\tag{18}
$$

This should be seen against the usual dimensional analysis, assuming that $k_B = \hbar = c \to 1$ in dimensional analysis which would be seen as akin to the more usual [15]

$$E_{ext} = \frac{k_B}{2} \cdot T_{applied} \approx \tilde{M} \cdot c^2 \xrightarrow[k_B = \hbar = c \to 1]{} \omega_{GW} \quad (19)$$

i.e. the higher one is getting to a huge applied temperature we would be looking at a system approaching Eq. (19) .

In addition, if we are referring to a ring singularity[1] in an induced Kerr-Newman black hole, we would have say [76]

$$\begin{aligned} &\lambda_{GW} v_{GW} \equiv 2\pi \lambda_{GW} \omega_{GW} \approx c \equiv 1 \\ &\Rightarrow \lambda_{GW} \approx 1/2\pi \, \omega_{GW} \\ &If \, \lambda_{GW} \geq Radius - of - Ring \\ &Radius - of - Ring \approx 1/2\pi \, \omega_{GW} \end{aligned} \quad (20)$$

If the radius of the (black hole Singularity) ring, is not on an angstrom scale, it is easy to postulate that one is having at least a 10^ 10 Hz frequency, in emitted radiation, and the strength of the GW, can be easily made, with adjustment in input parameters, so h ~ 10^ 23 is probable. I.e. this should be seen in the light of having a suitable applied temperature $T_{applied}$ applied to the artificial Kerr-Newman black hole provided that we are looking at, say

$$h \sim GW - strength = \left(\frac{\hbar \omega_{GW}}{4\pi \omega_{Laser-light} W_{Laser-light}} \right)^{1/2} \propto 10^{-23} \quad (21)$$

**** NOTE, DUE TO THE LENGTH OF THE PRIOR DOCUMENT, OVER 65%, INCLUDING ALL REFERENCES WERE REMOVED. INTERESTED PERSONS CAN OBTAIN THE ORIGIONAL BY E MAILING rwill9955b@gmail.com ****