Electromagnetism and Gravity field equations are unified and described by a new E(4,0) tensor for total energy representing the new conformal energy tensor T(4,0) and the stress-energy tensor T(2,0)

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Abstract

Electromagnetism and Gravity field equations are unified and described by a new E(4,0) tensor for Total Energy representing the new Conformal Energy tensor T(4,0) and the Stress–Energy tensor T(2,0). In four dimensions electromagnetic field tensor is defined as a differential 2-form F that constructs electromagnetic stress–energy tensor as a combination of F and the Hodge dual of F, in Einstein field equations this role is played by the Weyl tensor C, the conformal tensor curvature is the only part of the curvature that exists in free space and governs the propagation of gravitational waves, so the conformal energy tensor can be defined as a combination of C and the Hodge dual of C. The Hodge dual definition of electromagnetic tensor and Weyl tensor leads to electromagnetic field tensor embedded in Weyl tensor unifying Electromagnetism and Gravity, both tensors are related to the Conformal Energy tensor

Conformal energy tensor defined as a combination of Weyl tensor C and the Hodge dual of C

In Einstein field equations the Weyl tensor **C**, the conformal tensor is the only part of the curvature that exists in free space and governs the propagation of gravitational waves

$$C_{ik\ell m} = R_{ik\ell m} + \frac{1}{n-2} \left(R_{im} g_{k\ell} - R_{i\ell} g_{km} + R_{k\ell} g_{im} - R_{km} g_{i\ell} \right)$$
$$+ \frac{1}{(n-1)(n-2)} R \left(g_{i\ell} g_{km} - g_{im} g_{k\ell} \right).$$

where R_{abcd} is the Riemann tensor, R_{ab} is the Ricci tensor, R is the Ricci scalar (the scalar curvature)

The conformal energy tensor **T** can be defined as a combination of **C** and the Hodge dual of **C** [1]

$$T_{abcd} = 1/8\pi (C_{alcd} C^l_{bcd} + *C_{alcd} *C^l_{bcd} + C_{abmd} C^m_{acd} + *C_{abmd} *C^m_{acd} + C_{abcn} C^n_{abd} + *C_{abcn} *C^n_{abd})$$

Hodge dual definitions

The Hodge dual definition for Electromagnetic tensor and Weyl tensor [2]

$*F_{ab} = \frac{1}{2}\varepsilon_{abln}F^{ln}$

$*C_{abcd} = \frac{1}{2}\varepsilon_{abln}C^{ln}_{cd}$

The similarities between the Hodge dual definition for electromagnetic tensor and Weyl tensor leads to see the electromagnetic field tensor embedded in Weyl tensor unifying Electromagnetism and Gravity, both tensors are related to the new Conformal Energy tensor.

Electromagnetism and Gravity field equations

Now, Electromagnetism and Gravity are unified and field equations are described by a new E(4,0) tensor for Total Energy representing the new Conformal Energy tensor T(4,0) and the stress-energy tensor T(2,0)

$R_{abcd} - \frac{1}{4}Rg_{ab}g_{cd} = -kE_{abcd}$

In the general theory of relativity the Einstein field equations relate the geometry of spacetime to the distribution of matter. [3]

$R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} + \Lambda g_{\mu\nu} = -\kappa T_{\mu\nu}$

References

[1] Jesus Delso Lapuerta, https://vixra.org/abs/2012.0093, "On the conformal energy tensor defined as a combination of Weyl tensor and the Hodge dual of Weyl tensor"

[2] See Chapter 32, 32.2 in: Roger Penrose, "The Road to Reality", Jonathan Cape, London 2004

[3] See Page 175 in: Albert Einstein, "El significado de la relatividad" / "The meaning of relativity", Planeta - De Agostini, Barcelona 1985