

RESEARCH ARTICLE

# Quantum Gravity to Unification of Quantum Field Theory (QFT) and General Relativity Theory (GRT)

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Received: 17 November 2025 Accepted: 03 December 2025 Published: 09 December 2025

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## Abstract

The idea that the energy of the gravitational field is an equivalent of the dark energy of the universe [1] leads to quantum gravity. The calculation of dark energy is based on quantum theory ( $E = h \nu$ ) and the energy of the gravitational field is based on the Gravity Theory (GT). The unification leads to quantum gravity.

The result leads to formulas (II), (III), (IV) and (V), see “Derivation of formulas for unification of QFT and GRT”, next section.

For the first time, the unification of Quantum Field Theory (QFT) with General Relativity Theory (GRT) was initiated with prospects of success. The way to Quantum gravity is shown. Further research is needed.

**Keywords:** Unification, Dark Energy, Calculation, Gravitational Field, Universe.

## 1. Overview

The present research article aims to demonstrate a possible path to quantum gravity and to join the many existing works on the subject. The relevance of the work will have to be proven in the future.

## 2. Background

Various approaches have been taken to formulate Quantum Gravity. These include among others, the string theory and loop quantum gravity (SQG). SQG describes a dynamic quantum mechanical network of lines and nodes, which implies a quantization of space and time. New theories and some approaches suggest that gravity may not be a fundamental force, but an emergent property arising from the entropy - also called SHANNON's information entropy - of quantum states [2]. The fundamental force seems to arise from the concept of information. Information flow is known to be equivalent to energy, which also involves force. There are also some theories for new concepts of time [3] and for reconciling quantum mechanics with the expanding universe through dark

energy. A recently published paper considers gravity not as a force build into the fabric of spacetime, but as something that arises from the behavior of ordinary matter at the quantum level.

Rut Kastner of the University of Maryland and Andreas Schlatter of the Quantum Institute in New York developed a model in which space and time themselves are not fundamental, but result from electromagnetic interactions between charged systems such as atoms and molecules.

Spacetime is therefore created by photon exchange. Spacetime events and their structural connections arise from these transactions such as emission and absorption events. When atoms and molecules emit or absorb photons, electromagnetic force transfer occurs.

Researchers are trying to apply the entropy-based description to dark matter and dark energy. Gravitational waves in spacetime, which are recorded by observatories such as LIGO, are to be described within the framework of the new theory. Instead of

**Citation:** Friedhelm M. Joge. Quantum Gravity to Unification of Quantum Field Theory (QFT) and General Relativity Theory (GRT). Open Access Journal of Physics. 2025; 7(3): 29-32.

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being waves in a itself. Our understanding of the universe, from its smallest particles to the largest structures and the dark universe, could be taken to a higher level by the new theory.

### 3. Introduction

The unification of Quantum Field Theory (QFT) with General Relativity Theory (GRT) is the dream of theoretical physicists. It has not been successful to date. However, a first approach has been made in this article and this first approach needs to be further formulated theoretically.

### 4. Derivation of Formulas for Unification of QFT and ART

The formula (1.2) in my article „Theory of Dark Energy“ [4] and „Calculation of Dark Energy and Dark Matter“ [5 page 1] and the formulas (1) and (2) in the article „Energy of the Gravitational Field as an Equivalent of the Dark Energy of the Universe“ [1] are as follows.

$$E_d = h t_{up} / t_p \quad (I)$$

$$E_d = (h/t_p^2) \cdot t_u \quad (1.2)$$

$$\text{or in general form: } E = (h/t_p^2) \cdot t \quad (1.2)$$

$$\text{and} \quad E_d = E_g \quad (a)$$

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$$E_g = (h c^5 / G)^{1/2} \quad (1)$$

$$E_d = E_g \cdot (t_u / t_g) \quad (2)$$

From this we can deduce:

$$t_u = (c^5 / hG)^{1/2} \cdot t_p \quad (II)$$

$$t_u = c^5 / G \quad (III)$$

$$E_d = h t_g / t_p^2 \quad (b)$$

$$E_d = h c^5 / (G t_p) \quad (IV)$$

$$t_g = t_u \quad (V)$$

to (b):

$$E_d = (h/t_p^2) \cdot t_u, E_d = E_g \cdot (t_u/t_g), E_d \cdot t_g = E_g \cdot t_u, (h/t_p^2) \cdot t_u \cdot t_g = E_g \cdot t_u, h/t_p^2 \cdot t_g = E_g, E_d = h t_g / t_p^2$$

Formula (1.2) and (2) provides the values  $0.994 \cdot 10^{71}$  J and  $1.58 \cdot 10^{70}$  J. See „Application“.

### 5. Application

The value of dark energy can be calculated in two different ways.

By using formula (1.2) given in my article „Calculation of Dark Energy and Dark Matter“ [4

page 1]. It reads:  $E_d = (h/t_p^2) \cdot t_u$ . The value can be found in Table 1 on page 4 and is:  $0.994 \cdot 10^{71}$  J.

By using formula (1) and (2) given in the article „Energy of the Gravitational Field as an Equivalent of the Dark Energy of the Universe“ [1]. It reads:  $E_g = (h c^5 / G)^{1/2}$  and  $E_d = E_g \cdot (t_u/t_g)$ .

The value is:  $1.58 \cdot 10^{70}$  J.

The value for path 1 is 84,1 % higher than for path 2. This seems like a big difference, but at this scale it becomes more relative. It should also be noted that the value is a reasonable approximation considering that other calculations between theory and verification were wrong by over 100 order of magnitude.

The formula (1) is provisionally, points in the right direction towards quantum gravity, but requires further theoretical efforts.

Formula (II) provides a value for the age of the universe that is in very good agreement with the known value given in the literature; is stated:  $4.342 \cdot 10^{17}$  s ; is calculated:  $3.67 \cdot 10^{17}$  s.

The relatively good agreement of the value of the age of the universe shows the fundamental correctness of formula (II). Formula (II), (III) and formula (IV) thus a confirmation of the path found to the unification of quantum theory (QT) and general relativity (GRT) or quantum gravity.

Thus, formula (1.2) delivers exactly what Prof. Dr. Alexandre Tkatchenko from the University Luxemburg says: „Accurate Calculating the value of Dark Energy could be helps bring together two of the largest fields in physics: Quantum Field Theory (QFT) and the General Theory of Relativity (GRT) developed by ALBERT EINSTEIN.“

### 6. Conclusion

Formula (V) shows the unification of the quantum field theory (QFT) with the general theory of relativity (GRT) and leads to the result: „The age of the universe is equal to one oscillation period“.

This leads to the following questions.

- \* Is there an expansion and opposite contraction of the universe? This has been discussed many times.
- \* The phenomenon of coming and going also exists in nature, also known as the cycle of nature. Examples of this include.

- \* Nature changes between the seasons, such as spring, summer, autumn, and winter, day and night. Humans also have their own rhythm of day (activity, work) and night (sleep, rest).
- \* Dying / pass away and becoming: The seed must „die“ in order to produce ears of corn. Water that evaporates and forms clouds rains down again.
- \* Recycling plastic waste and save petroleum oil.

This first approach needs to be further formulated theoretically.

## 7. Summary

Entropy – SHANNON's information entropy – is, according to the new theory of a Schlatter and RE Kastner, the emergent property that generates gravity.

The fundamental force therefore seems to arise from the Information in the universe, just as information makes up the entire universe: Energy is equivalent to dynamic information, as well time. There is a prospect of reconciling the dark energy of the expanding universe with quantum mechanics.

Gravity arises from the behavior of ordinary matter at the quantum level. RE Kastner and Andreas Schlatter developed a model in which space-time results from electromechanical interactions between charged systems such as atoms and molecules and is created by photon exchange – emission and absorption – and the electromagnetic force transmission occurs.

According to the new theory, gravitational waves in space-time arise from changes in the motion of the mass itself. Our understanding of the universe from the smallest particles to the largest structures and the dark universe could be raised to a higher level by the new theory.

Mathematical formulations (II), (III), and (IV) present the Quantum Gravity and thus a confirmation of the path found to the unification of Quantum Theory (QT) and General Relativity Theory (GRT) or Quantum Gravity.

The relatively good agreement of the value for the age of the universe shows the fundamental correctness of formula II. The age of the universe is equal to one oscillation period.

This leads to questions regarding expansion or opposite contraction of the universe and the relationship between small and large things. There is the property of coming and going, which also exists in the cycle of nature. Dying and becoming also exist in nature.

## Definition of Symbols Used in Formulas

$E$  = energy

$E_d$  = dark energy

$E_b$  = energy equivalent of visible baryonic matter

$t$  = time

$t_u$  = age of the universe  $t_u = 13.75$  billion years =  $4.326 \cdot 10^{17}$  s =  $4,342 \cdot 10^{17}$  s in 13,8 billion years

$t_p$  = PLANCK time

$t_{up} = t_u / t_p$  = age of the universe in PLANCK time units

$t_g$  = period of oscillation <sup>1)</sup>

$h$  = PLANCK's quantum of action

$G$  = constant of gravitation

$c$  = speed of light

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<sup>1)</sup>Oscillations are fundamental oscillations of the cosmic space [6, pg.15]. THOMAS GÖRNITZ says: „Structural quanta emerge from a quantum-theoretical description of „oscillation states“ of a system around its ground state. They produce many effects. The AQIs of protyposis are also structural quanta and not particles. One can interpret them as the „fundamental oscillations of the cosmic space“.)

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