# Space-time equation of oscillation energy in linked shell-model – analogon of damping energy

Holger Döring
IQ-Wissen Berlin
Germany
DPG-departement: matter and cosmos
section: GRT and gravity
e-mail: holgerdoering@alumni.tu-berlin.de

## Abstract:

The differential equation of second order for space-time-oscillation in flat tangential-spacetime of Minkowski-type can be written as an energy-equation. For this energy-equation the analogon of damping energy in two coupled Minkoswki-spacetimes with ftl can be calculated and formulated over Lamberts W-function or via Euler-equation.

**Key-words:** energy-equation; differential-equation; second-order; ftl; coupled-spacetimes; damping energy; linked shell-model; spacetime oscillation equation; Lambert-W-function; Euler-equation.

## 1.Introduction:

The model of damped resonance can be used for special situations of spacetime description [1.], [2.].Particularly for states of oscillating spacetime. For nondamped states there is in two dimensions $x, ict$ the system amplitude square of classical Lorentz-factor [1.],[2.]. This differential-equation (DE) can be modeled to an energy description. There can be given a solution of this description in Planck-energy form. If this equation is developed to its formal general form of a damping system, there can be derived a solution for needed damping energy of spacetime to construct ftl-states by using two local flat spacetimes [3.],[4.], [5.]. This model of ftl-state is called the „linked shell-model" because there are two local, flat Minkowski-spacetimes „linked" together over an outer damping-term like a hinge of two halfs to an image form of a closed shell [5.]. The needed Energy for this damping-state is now constructed with special-case of Planck- energy for undamped state. The damping-state-energy can be described over Lambert-function (LaF) or via Euler-equation.This will be done. Without damping-term the double-spacetimes are taken apart into two seperate states without a link and so without coupling to two ordinary flat Minkowski-spaces.

### 2.Calculation:

The general second-order DE of space-time description is given:

$$A\cdot\ddot{\psi}+A\cdot B\,\dot{\psi}+(A\cdot C-D)\cdot\psi=0 \qquad (1.)$$

with its assigned variables of:

1. System-amplitude $A$ : $A=\frac{1}{\sqrt{(1-\frac{v^2}{c^2})^2+\frac{n\cdot a^2\cdot v^2}{c^4}}}$ (2.)

which reduces for $a\equiv 0$ to squares of classical SRT-Lorentz- and Feinberg-factors[6.],[7.] and is square of advanced Lorentz-term for damped spacetime-states.The term $a$ is damping velocity, the term of $v$ is constant velocity of local inertial frame.

2. Damping-factor $B$ : $B=\frac{W_d}{\hbar}$ (3.)

with $W_d$ - damping energy,

3. Function-term $C$ :

$$C=\frac{W_{Pl}}{\hbar}=\omega_{PL} \qquad (4.)$$

and:

4. Function-term $D$ :

$$D=\frac{W_{PL}}{\hbar}\cdot e^{i\cdot\frac{W_d}{\hbar}\cdot t} \qquad (5.)$$

where $\frac{W_d}{\hbar}\cdot t=\frac{W_d}{\hbar\cdot\Omega}=\theta$ is phaseangle of space-time planewave state,

which reduces for classical Lorentz-Einstein-Feinberg-factor to: $\theta=\pm 1$ (See [1.])

Also given is the state of an oscillating plane-wave function of local, flat spacetime :

$$\psi=A\cdot e^{i\cdot\frac{r}{r_{PL}}-\theta} \qquad (6.)$$

Then this all leads to the general equation of:

$$A\cdot\ddot{\psi}+A\cdot\frac{W_d}{\hbar}\cdot\dot{\psi}+\left(\frac{W_{PL}}{\hbar}\right)^2\cdot\left(A-e^{\frac{i\cdot W_d}{\hbar}\cdot t}\right)\cdot\psi=0 \qquad (7a.)$$

for damping states of local space-time, and

with its special case for $W_d\equiv 0$ to :

$$\hbar^2 \cdot \ddot{\psi} + W_{PL}^2 \cdot \frac{v^2}{c^2} \cdot \psi = 0 \qquad (7b.)$$

for a trivial flat encoupled single spacetime (respectively the two of them) without linking, which leads straight to the right statement of:

$$W_{PL} = \omega_{PL} \cdot \hbar \qquad (8.)$$

But the last equation of (8.) isn‘t surprising or a miracle because it is only that result, from what information is taken first into the equation and proves only its mathematical truthful logical quality, nothing else.
In this respect, its result is a real sort of trivia, no new physics.
More interesting is equation (7a.) because it allows to calculate now the energy $W_d$ , which is needed to „damp“ the oscillating wavefunction of local flat space-time for causing ftl-cases of velocities for moving material bodies and link the two needed space-time states together. This calculation yields to the selfreferential equation of:

$$W_d = \frac{\hbar \cdot v}{r_{PL}} - \frac{W_{PL}^2 \cdot r_{PL}}{\hbar \cdot v} + i \cdot \frac{W_{PL}^2 \cdot r_{PL}}{\hbar \cdot A \cdot v} \cdot e^{\frac{i W_d \cdot t}{\hbar}} \qquad (9.)$$

The limiting case for $W_d \equiv 0$ leads to the classical spacetime-case of $W_{PL} = \hbar \cdot \omega_{PL}$ as it must-like equation (7a.) above. So this equation (9.) for „damping energy of local spacetime“ can be seen at least as mathematical logically consistent if would turn out, that it‘s not really physical. It should always be pointed out that the term “damping”, which is in the model used, is only an analogy and does not have to correspond to the actual, real condition of the physical states because the interpretation of all these terms is not yet fully clear. There doesn’t have to be a real damping. This is only a model of description.
Indeed, the equation (9.) is from the selfreferential type of :

$$f(x) = a + i \cdot b \cdot e^{i \cdot c \cdot f(x)} \qquad (10a.)$$

This can be easily transformed into:

$$f(x) = a - \frac{1}{c} \cdot \boldsymbol{W}(-b \cdot c \cdot e^{a \cdot c}) \qquad (10b.)$$

and can be solved over Lamberts W-function [8.],[9.],[10.]. The solution for analogon of damping-energy therefore is then consistent with this term (10b.), which leads to the final solution for damping energy of:

$$W_d = \frac{\hbar \cdot v}{r_{PL}} - \frac{W^2_{PL} \cdot r_{PL}}{\hbar \cdot v} - \frac{\hbar}{i \cdot t} \cdot \boldsymbol{W}_{(-1;0)} \left( -i \cdot \frac{W^2_{PL} \cdot r_{PL} \cdot t}{\hbar^2 \cdot A \cdot v} \cdot e^{i \cdot \left( \frac{\hbar \cdot v}{r_{PL}} - \frac{W^2_{PL} \cdot r_{PL}}{\hbar \cdot v} \right) \cdot \frac{t}{\hbar}} \right) \qquad (11a.)$$

where $\boldsymbol{W}$ is the Lambert-function. This term can be rewritten or rather reduced to:

$$W_d = \frac{\hbar \cdot v}{r_{PL}} - \frac{W_{PL} \cdot c}{v} + i \cdot \hbar \cdot \Omega \cdot \boldsymbol{W}_{(-1;0)} \left( -i \cdot \frac{\omega_{PL} \cdot c}{A \cdot v \cdot \Omega} \cdot e^{i \cdot \left( \frac{v}{\Omega \cdot r_{PL}} - \frac{\omega_{PL} \cdot c}{v \cdot \Omega} \right)} \right) \qquad (11b.)$$

The main question is now: when is this term (11a./11b.) real, when are there real damping energies? Instead of using the Lambert-function for this examination , it is easier to solve this problem via Euler- equation and equations (9.) and (10a.):

Equation (10a.) can be written as:

$$f(x)=a-b\cdot\sin(c\cdot f(x))+i\,b\cdot\cos(c\cdot f(x)) \quad . \tag{12.}$$

The question is, under which circumstances the imaginary cos-term in equation (12.) vanishes, to get real values. This is the case for

$$c\cdot f(x)=(2\cdot n+1)\cdot\frac{\pi}{2};n\in\mathbb{Z} \tag{13.}$$

Then equation (12.) reduces to:

$$f(x)=a-b\cdot\sin(c\cdot f(x)) \tag{14.}$$

This equations (13.) and (14.) on the other hand means a case distinction in:

$$f_1(x)=a-b \quad for \quad f(x) = \frac{(4\cdot n+1)}{c}\cdot\frac{\pi}{2} \; ; \; n\in\mathbb{Z} \tag{15a.}$$

and

$$f_2(x)=a+b \quad for \quad f(x)= \frac{(4\cdot n-1)}{c}\cdot\frac{\pi}{2} \; ; \; n\in\mathbb{Z} \tag{15b.}$$

This leads finally in closer examination to equations for the physical statements of damping energies of:

$$W_{d_1}=\frac{\hbar\cdot v}{r_{PL}} - \frac{W^2{}_{PL}\cdot r_{PL}}{\hbar\cdot v}\cdot\left(1+\frac{1}{A}\right) \; for \; W_d = \frac{\hbar}{t}\cdot(4\cdot n+1)\cdot\frac{\pi}{2}; \; n\in\mathbb{Z} \tag{16a.}$$

and

$$W_{d_2}=\frac{\hbar\cdot v}{r_{PL}} - \frac{W^2{}_{PL}\cdot r_{PL}}{\hbar\cdot v}\cdot\left(1-\frac{1}{A}\right) \; for \; W_d = \frac{\hbar}{t}\cdot(4\cdot n-1)\cdot\frac{\pi}{2}; \; n\in\mathbb{Z} \tag{16b.}$$

This equations also can be written as:

$$W_{d,1}=\hbar\cdot\Omega\cdot(4n+1)\cdot\frac{\pi}{2}=\frac{\hbar\cdot v}{r_{PL}}-\frac{W^2{}_{PL}\cdot r_{PL}}{\hbar\cdot v}\cdot\left(1+\frac{1}{A}\right); \; n\in\mathbb{Z} \tag{17a.}$$

and

$$W_{d,2}=\hbar\cdot\Omega\cdot(4n-1)\cdot\frac{\pi}{2}=\frac{\hbar\cdot v}{r_{PL}}-\frac{W^2{}_{PL}\cdot r_{PL}}{\hbar\cdot v}\cdot\left(1-\frac{1}{A}\right);\ \ n\in\mathbb{Z} \tag{17b.}$$

where $\Omega$ is the damping frequency of oscillating spacetime-system.For transition to GRT there has to be taken into account that there must be distinguished between covariant and contravariant vectorfields in both coupled spacetimes.

Boundary conditions for this energy-system can be get via solving the Lambert-function:
Answer: this whole term for $W_d$ is real, when the Lambert-function

$$\boldsymbol{W}_{(-1,0)}=i\cdot k,k\in\mathbb{R} \tag{18.}$$

This condition is (after some calculations) fulfilled for BC- terms of

$$v\leq\sqrt{2\cdot c^2-n\cdot a^2};a\leq\sqrt{\frac{2}{n}}\cdot c; \tag{19.}$$

as known from former papers [3.],[4.].

Remark: $n=4$ can be chosen from tradition of damped resonance-model for oscillating bodies. If only the term $\boldsymbol{W_0}$ is chosen, the definition area of $k$ is restricted to $-\frac{\pi}{2}\leq k\leq\frac{\pi}{2}$ .

## **3.Conclusion:**

The analogon of a form of „damping energy“ for oscillations in Planck-area for local, flat spacetimes can be formulated. This spacetime state of damping allows coupling of two tangential-four spaces [3.] via a link (linked shell-model of two spacetimes) like a hinge and breaks the limit of maximum local invariance velocity of $c_0$ for material bodies[1.],[5.] . Further informations for conditions of this case are found in [3.]
Experimental measurement of effects could be difficult today, for all expected physical effects are small and leads in their limits to conditions of classical SRT, so that coupling to former theories after the modern theories of science-models are fullfilled [11.].The possibilty of existence of two solutions in $\boldsymbol{W}$ could lead to speculations over interpreting one of them as a „damping“, the other as a „stimulating“ process but this is not a consistent assuming and has to be proven.

## **4. Summary:**

The analogon of a form of „damping-energy“ for oscillating flat space-times can be calculated to get ftl-states for movements of matter with a special case without a „damping process“ for getting Planck-energy. It seems, that solutions for the damping process leads possibly to mathematical complex values in $\mathbb{C}$ , but real values are possible also which could be interpreted physically under special circumstances. These terms has to be calculated over Lambert-function $\boldsymbol{W}$ or via Euler-equation.

## **5.References:**

[1.] Döring, H., Eigenwertproblem of advanced Lorentz-Einstein-Factor. **2023**,

DOI: https://doi.org/10.5281/zenodo.7839791
https://hal.science/hal-04068591 .

[2.] Döring, H., Developed Lorentz-Einstein SRT-k-factor of fouth order as an amplitude-solution of damped, planck-scaled oscillation equation.**2021**,() . https://hal.archives-ouvertes.fr/hal-03379818v1

[3.] Döring, H., SRT as a fourth-order-theory with analogy-model of damped resonance, Preprints **2021**,, 2021040433 (doi: 10.20944/preprints 2021104.0433v1). (https://www.preprints.org/manuscript/202104.0433/v1).

[4.] Döring, H., Energy conditions in advanced SRT of fourth order.**2021** hal-03430522v1. (https://hal.archives-ouvertes.fr/hal-03430522v1).

[5.] Döring, H. , Beyond the light-barrier – faster-than-light space-travel with controlled line-elements of coupled space-times in fourth order. Doi:https://zenodo.org/record/7477923

[6.] Einstein, A., Zur Elektrodynamik bewegter Körper, Annalen der Physik, **322**,10,1905. DOI:https://doi.org/10.1002/andp.19053221004 .

[7.] Feinberg, G., Possibilty of faster-than-light-particles,Phys.Rev.**159**,1089, (1967). DOI: https://doi.org/10.1103/PhysRev.159.1089 .

[8.] P. S. Farrugia, R. B. Mann, T. C. Scott: *N-body Gravity and the Schrödinger Equation.* In: *Class. Quantum Grav.* 24, 2007, S. 4647–4659. doi:10.1088/0264-9381/24/18/006; Arxiv-Artikel.

[9.] R. M. Corless u. a.: *On the Lambert W function.* (Memento vom 14. Dezember 2010 im *Internet Archive*). (PDF; 304 kB). In: *Adv. Computational Maths.* 5, 1996, S. 329–359.

[10.] Eric W. Weisstein: *Lambert W-Function*. In: *MathWorld* (englisch).

[11.] Popper, Karl,**1934**, Logik der Forschung. Zur Erkenntnistheorie der modernen Naturwissenschaft. 11. Aufl. 2005, ISBN 3-16-148410-X

## 6. Acknowledgements:

Many thanks go to user „MonthyPythagoras“ from the (german) internet-portal „Matroids Matheplanet“, who advised some suggestions for solving the basics of the pure formal mathematical problem without knowing the physical background and especially to user „HAL 9000“ from the german netportal „MatheBoard“ who did the same. Also many thanks to user „Diophant“ from „Matroids Matheplanet“ for the advice of using the Lambert-function and to Jonni Westfalen from the same platform (user „polygamma“), former research fellow at FH Kiel, university of applied sciences, for working out some special cases of the LF.

## 7.Verification:

This paper is written without using a chatbot like ChatGPT - 4 or other chatbots or AIs. It is fully human work.

Oktober 2023