

# THE LAW OF CONSERVATION OF ENERGY FOR DISCONTINUOUS AND CONTINUOUS FUNCTIONS IN THE CONTEXT OF ACTA UNIVERSI

## 1. CLASSICAL PRODUCTION: CONTINUOUS CASE

In standard physics, the law of conservation of energy is expressed in terms of a **continuous equation** (differential form):

$$\frac{\partial \rho}{\partial t} + \nabla \cdot \mathbf{j} = 0$$

or in covariant form (GR):

$$\nabla_{\mu} T^{\mu\nu} = 0$$

Here  $T^{\mu\nu}$  is the energy-momentum tensor, and  $\nabla_{\mu}$  is the covariant derivative.

Functions describing fields and matter are assumed **to be smooth and continuous** (except for isolated singularities).

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## 2. FEATURES OF THE AU FIELD: DISCONTINUITY AND INFORMATION EVENTS

In the **Acta Universi (AU-field) hypothesis** dark energy is interpreted as a **dynamic archive of events**. This results in two types of processes:

| Type                            | Character                                | Examples  |
|---------------------------------|--|---|
| <b>Continuous</b>               | Smooth field evolution                   | Wave propagation, planetary motion, fluid flow  |
| <b>Discontinuous (discrete)</b> | Spasmodic changes, "recording" of events | Quantum measurements, collapse of the wave function, act of consciousness (thought form), birth/death of a particle |

The AU field  $\mathcal{A}_{\mu}$  itself can experience **discontinuities** and **jumps** at points where irreversible information recording occurs.

### 3. GENERALIZED CONSERVATION LAW IN THE AU-FIELD

#### 3.1. Continuous component

For smooth fields, the standard equation is preserved:

$$\nabla_{\mu} T_{mat}^{\mu\nu} + \nabla_{\mu} T_{AU}^{\mu\nu} = 0$$

where  $T_{AU}^{\mu\nu}$  is the energy-momentum tensor of the AU field itself.

#### 3.2. Contribution of discontinuous events

Each **irreversible event** (an entry in the AU log) creates a local jump in the energy density and entropy  $S_{\Theta}$ . This jump is described **by an integral condition** (analogous to the conservation law on discontinuity):

$$[T_{total}^{\mu\nu}]_{\Sigma} n_{\nu} = \Delta j_{AU}^{\mu}$$

where:

- $\Sigma$  is the hypersurface of the discontinuity,
- $[\cdot]_{\Sigma}$ — jump of the value when passing through  $\Sigma$ ,
- $n_{\nu}$  is the normal to  $\Sigma$ ,
- $J_{AU}^{\mu}$ — change in the flow of AU information.

In terms of the entropy of thought forms  $S_{\Theta}$ :

$$\Delta E = \Delta(k_B T_{AU} \ln \Omega_{\Theta}) + \lambda \Delta \left( \int \rho_{AU} dV \cdot \frac{dN}{dt} \right)$$

The first term is the contribution from the change in the number of microstates ( $\Omega_{\Theta}$ ), and the second term is the contribution from the event recording rate.

#### 3.3. Unified equation with a source

Combining the continuous and discontinuous parts, we obtain **an inhomogeneous conservation equation**:

$$\nabla_{\mu} T^{\mu\nu} = J_{AU}^{\nu}$$

where  $J_{AU}^{\nu}$  — **JAU-v-AU is the current**, which is nonzero only at the points/moments of discontinuous events. In spacetime with distributed events:

$$J_{AU}^{\nu}(x) = \sum_i \delta^{(4)}(x - x_i) \cdot \Delta p_i^{\nu}$$

(total for all events of the record).

## 4. THE CONNECTION TO DARK ENERGY AND THE EXPANSION OF THE UNIVERSE

The classical conservation of  $\mu_\mu T^{\mu\nu} = 0$  in cosmology leads to the law of evolution of the energy density:  $\dot{\rho} = -3H(\rho + p)$ . For dark energy with the equation of state  $p = w\rho$ :

- If  $w = -1$  (cosmological constant),  $p = \text{const.}$
- If  $w < -1$  (phantom energy),  $p$  increases with time — the usual conservation is violated, an external source is required.

In the AU model, **the growth** of  $P_{AU}$  (dark energy density) occurs precisely due to discontinuous events (recording to the archive):

$$\frac{d\rho_{AU}}{dt} = -3H(\rho_{AU} + p_{AU}) + \Gamma_{AU} \cdot \frac{dS_\Theta}{dt}$$

Where  $\Gamma_{AU}$  is the coefficient of transformation of the entropy of thought forms into the energy of the AU field. Thus, **a full save** looks like this:

$$\frac{d}{dt}(p_{\text{mat}} + p_{\text{isl}} + p_{AU}) + 3H\left(p_{\text{mat}} + \frac{4}{3}p_{\text{isl}} + p_{AU} + p_{AU}\right) = 0$$

(here  $p_{AU} P_{AU} = -P_{AU}$  for the cosmological constant, but deviations are possible).

## 5. EXAMPLES OF DISCONTINUOUS PROCESSES IN THE AU-FIELD

### 5.1. Quantum collapse (measurement)

When measuring a quantum system, the wave function collapses — **a discontinuous event**. The energy of the system is conserved on average, but there **is a fluctuation** in the local energy density, which is transmitted to the AU field as an information jump. Formally:

$$\Delta E_{\text{system}} = -\Delta E_{AU} = \lambda \Delta S_\Theta$$

### 5.2. Thoughtform (act of consciousness)

A conscious intention or thought—the generation of a new thought-form—creates a local surge of  $S_\Theta$ . The corresponding energy change is drawn from (or transmitted to) the AU field. Balance equation:

$$\delta Q_{\text{consciousness}} = T_{AU} \delta S_\Theta$$

where  $T_{AU}$  is the effective AU temperature.

### 5.3. Tissue regeneration (treatment via AU chip)

In cancer therapy, the AU chip creates a  $\Delta S_\Theta$  gradient that "rewrites" the pathological pattern. In this case, the energy released during apoptosis of cancer cells is partially absorbed by the AU field, and partially converted into heat. Conservation Law:

$$\frac{dE_{\text{fabric}}}{dt} + \frac{dE_{AU}}{dt} + \frac{dQ_{\text{heat}}}{dt} = 0$$

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## 6. MATHEMATICAL FORMULATION FOR DISCONTINUOUS FUNCTIONS

Let  $E(t)$  be the total energy of the system at time  $t$ , experiencing jumps at times  $t_i$ :

$$E(t) = E_{\text{cont}}(t) + \sum_i \Delta E_i \Theta(t - t_i)$$

where  $\Theta$  is the Heaviside function. Then **the generalized conservation law** in integral form is:

$$E(t_2) - E(t_1) = \int_{t_1}^{t_2} P_{\text{ext}}(t) dt + \sum_{i:t_1 < t_i < t_2} \Delta E_i^{\text{AU}}$$

Where  $\Delta E_i^{\text{AU}}$  is the contribution from the exchange with the AU field (it can be either positive or negative).

For the continuous part:

$$\frac{dE_{\text{cont}}}{dt} = P_{\text{ext}} + \sum_i \Delta E_i \delta(t - t_i)$$

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## 7. THE LAW OF CONSERVATION OF ENERGY-INFORMATION

In the AU paradigm, the fundamental conserved quantity is **the sum of energy and information** (or energy and entropy taken with a certain sign). This is expressed in terms of a **generalized tensor**:

$$\tilde{T}^{mv} = T_{\text{mat}}^{mv} + T_{\text{AU}}^{mv} + \Theta_{\text{inf}}^{mv}$$

where  $\Theta_{\text{inf}}^{\mu\nu}$  is the information flow tensor. Then:

$$\nabla_{\mu} \tilde{T}^{\mu\nu} = 0$$

**without additional sources.** The discontinuity of events is "absorbed" into the structure of  $\Theta_{\text{inf}}^{\mu\nu}$ .

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## 8. CONCLUSION

In **the Acta Universi hypothesis**, the law of conservation of energy is generalized as follows:

| Aspect                      | Formulation                              |
|-----------------------------|--|
| <b>Continuous processes</b> | $\mu_{\nu} T^{\mu\nu} = 0$ (standard GR) |

| Aspect   | Formulation   |
|--|---|
| <b>Intermittent events (writing to the AU log)</b> | A jump in the energy $\Delta\Delta e$ is accompanied by a change in the entropy of thought forms $\Delta s S_\Theta$  |
| <b>Total conservation</b>                          | $\nabla_\mu (T_{\text{mat}}^{\mu\nu} + T_{\text{AU}}^{\mu\nu} + \Theta_{\text{inf}}^{\mu\nu}) = 0$                    |
| <b>Cosmological consequence</b>                    | An increase in dark energy ( $\rho_{\text{AU}}$ ) is compensated by a decrease in information entropy (or vice versa) |

Thus, **energy is not created or destroyed**, but can pass from the form of ordinary matter/fields to the **information form of the AU field** and vice versa. Discontinuity of functions — jumps) is a manifestation of the local heterogeneity of this transition.

In the limit of the absence of AU interaction and discontinuous events, the classical continuous conservation law is restored.

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*This generalization is a logical consequence of the AU-field axiomatics and does not contradict the experimental data (due to the smallness of AU-effects under the usual conditions).*

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