

Universal complexity in action

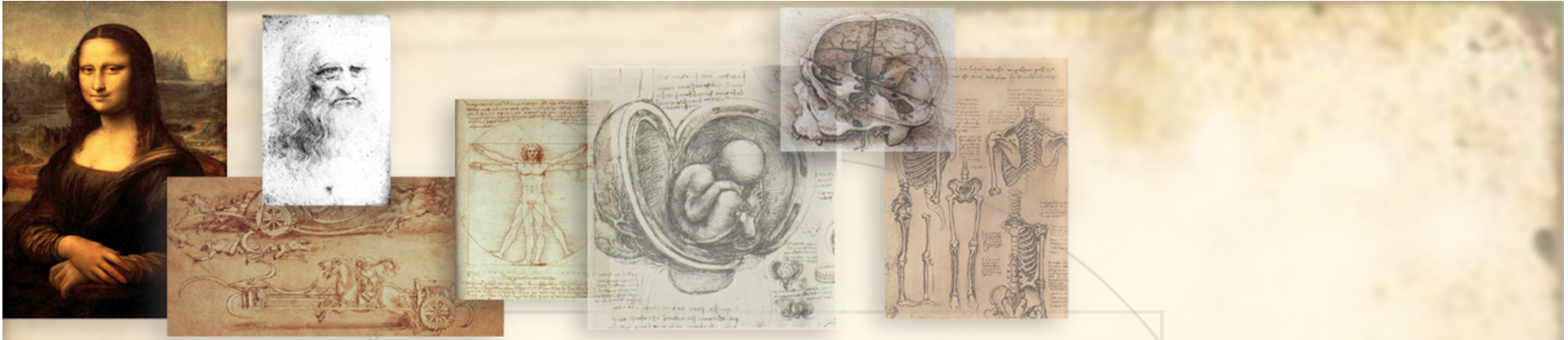
UNREDUCED COMPLEXITY APPLICATIONS

- Unified, causally complete fundamental physics (quantum mechanics, relativity, particles, fields, forces, cosmology): no “mysteries”, transparent, realistic knowledge and world view, the unique way to unlimited clean energy
- Real, complex-dynamic nanodevices (quantum & classical), huge efficiency
- Causally complete, reliable genomics (unreduced interaction dynamics)
- Complex-dynamic biology: causal evolution theory, integral medicine
- Creative ecology/development: realistic, unreduced sustainability concept
- Emerging genuine intelligence and consciousness (natural and artificial)
- Complex-dynamic, intelligent communication networks and software systems

UNREDUCED SUSTAINABILITY FEATURES

- Progress through permanent, constructive, omnipresent interaction: creating a superior, individually structured quality of life
- Practical responsibility of scientists for creation of “knowledge-based society” and “understanding-based (complete) knowledge”: no deficient “models”
- Constructive use of diversity instead of destructive mechanistic unification

<http://arxiv.org/find/quant-ph,gr-qc,physics/1/au:+Kirilyuk/0/1/0/all/0/1>

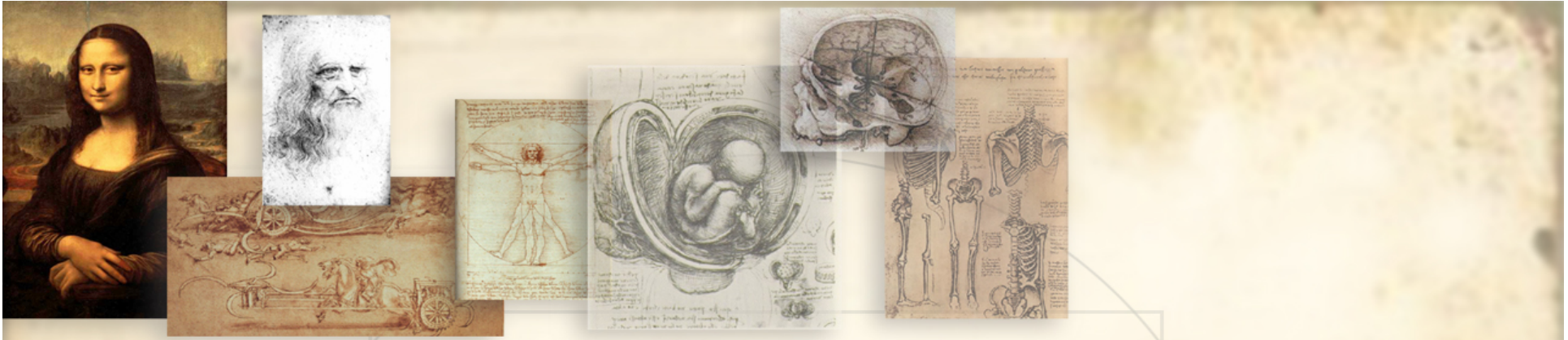


UNIFIED SCIENCE OF REAL COMPLEX SYSTEMS

Principles of Complex System Operation & Design

- I. Complexity correspondence principle**
Efficient interaction of comparable complexity units
- II. Complex-dynamic control principle**
Complexity development as the purpose of control
- III. Unreduced (free) interaction principle**
Huge power of unreduced interaction complexity

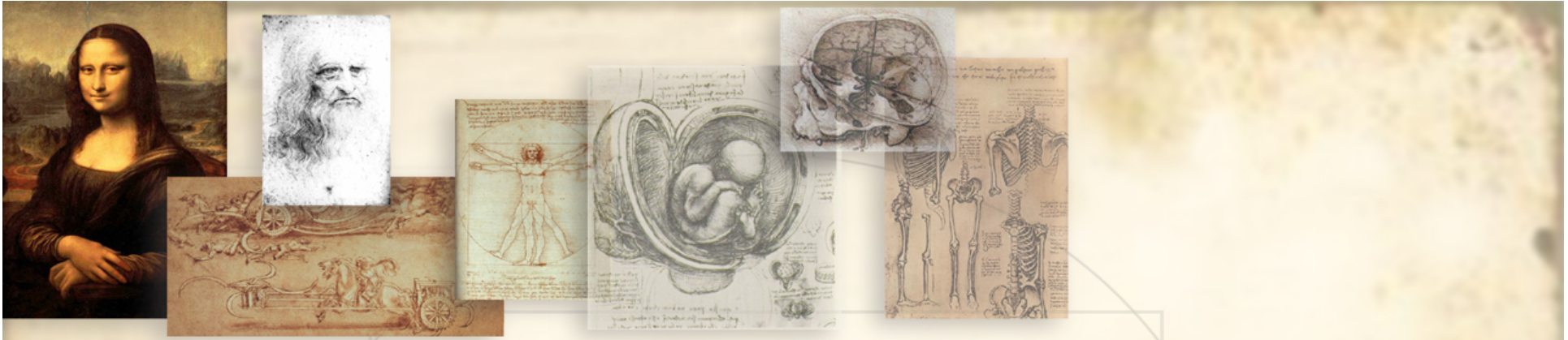
UNIFIED BY THE SYMMETRY OF COMPLEXITY



Complexity Correspondence Principle

Efficient Interaction of Comparable Complexity Units

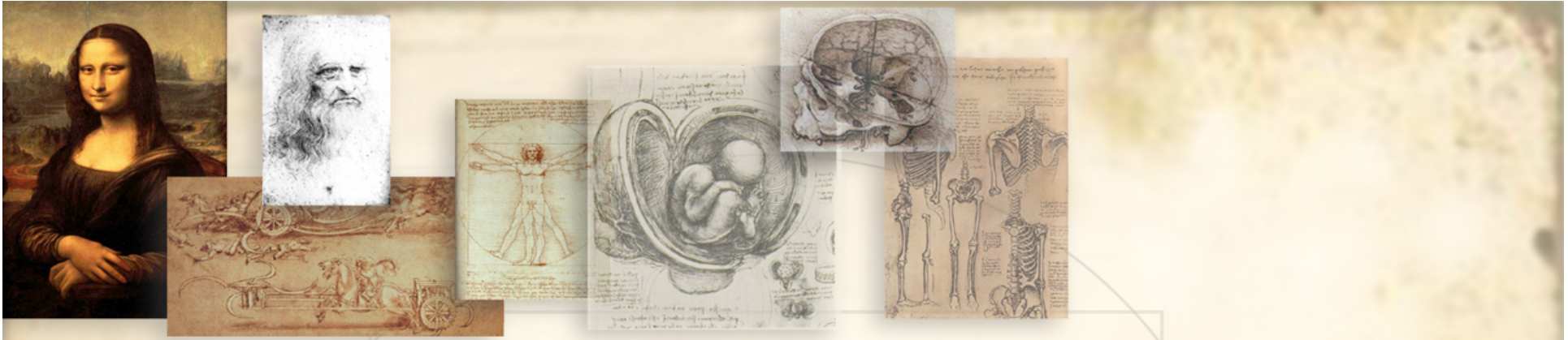
- ⌘ Higher complexity enslaves lower complexity
Low complexity **cannot** control/simulate high complexity
→ **only unreduced complexity** tools for **real** system design
- ⌘ Similar complexities give rise to strong chaoticity
Creative power of “confined” chaos (dynamic adaptability)
- ⌘ Excessive complexity tool replaces useful operation
Complex tools at context/software, **not** traffic/hardware level



Complex-Dynamic Control Principle

Complexity Development as Unified Control Purpose

- ❧ **Controlled dynamics cannot be totally regular**
Relying upon usual “total” control gives **total system failure**
Multivalued, chaotic SOC regime is a general control result
- ❧ **Optimal interaction complexity development**
Creative, rather than restrictive control is **more** reliable
- ❧ **Universal guiding line and criterion of control**
Sustainable control: global stability by local creativity



Unreduced (Free) Interaction Principle

Huge Power of Unreduced Interaction Complexity

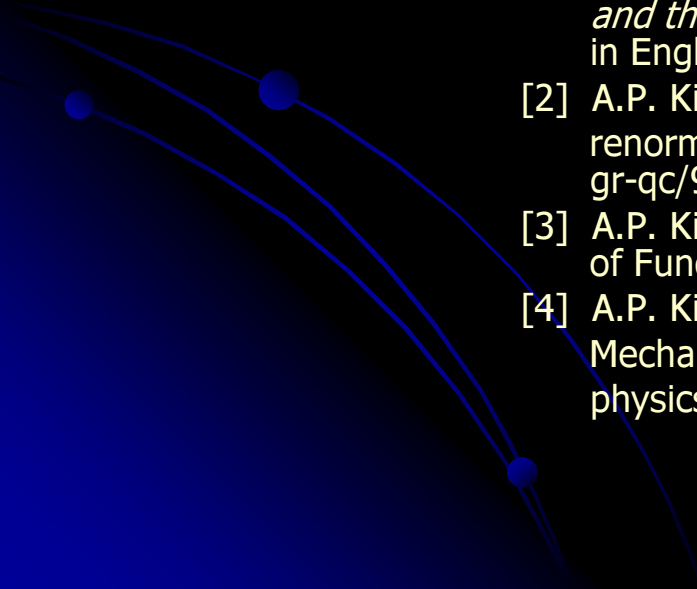
- ∞ **General purpose of complexity-entropy growth**
Only general direction is fixed/controlled, not the details
Intrinsic chaoticity is a normal, useful system state
- ∞ **Huge power of unreduced complex dynamics**
Genuine parallelism of multivalued dynamical fractal
- ∞ **Constructive alternation of strong chaos and SOC**
Symmetry of complexity: chaotic search and ordered creation

Unreduced complexity applications

- Causal universe origin and structure:
fundamental physics without mysteries
- Complex-dynamic nanoscience and biology:
reliable genomics and integral medicine
- Emerging intelligence and consciousness:
complex-dynamic interaction → genuine AI
- Complex-dynamic information systems:
intelligent software and autonomic networks
- Creative ecology and sustainability transition:
bifurcation of civilisation development

Complex-Dynamic Cosmology and Emergent World Structure

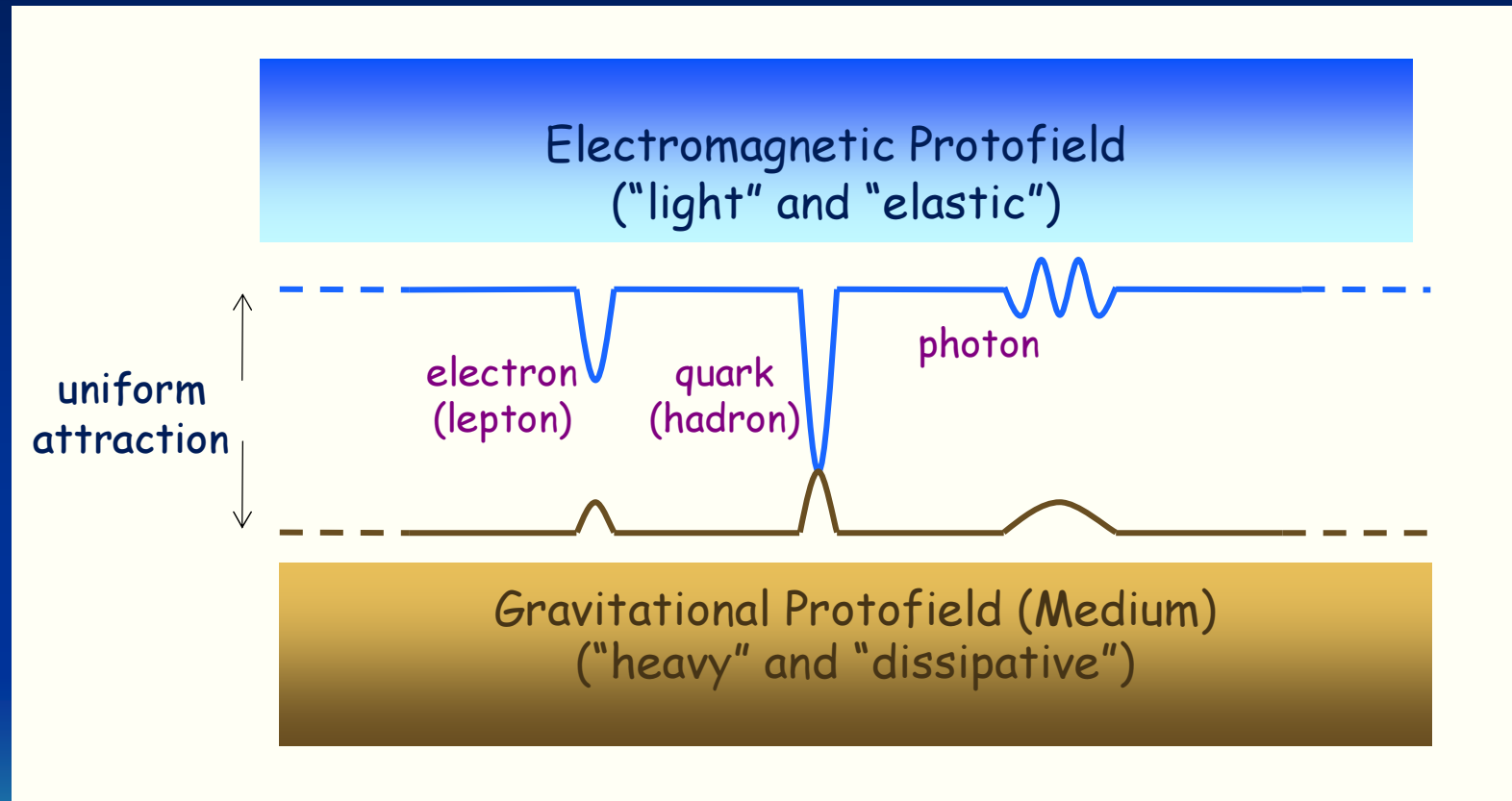
Causally complete understanding of truly autonomous universe structure formation and resulting world properties without mysteries by the universal concept of complexity

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- [1] A.P. Kirilyuk, *Universal Concept of Complexity by the Dynamic Redundance Paradigm: Causal Randomness, Complete Wave Mechanics, and the Ultimate Unification of Knowledge* (Naukova Dumka, Kiev, 1997), in English, 550 p. Nontechnical review: physics/9806002.
 - [2] A.P. Kirilyuk, "Universal gravitation as a complex-dynamical process, renormalised Planckian units, and the spectrum of elementary particles", gr-qc/9906077. Also quant-ph/9902015, quant-ph/9902016.
 - [3] A.P. Kirilyuk, "Quantum Field Mechanics: Complex-Dynamical Completion of Fundamental Physics and Its Experimental Implications", physics/0401164.
 - [4] A.P. Kirilyuk, "Consistent Cosmology, Dynamic Relativity and Causal Quantum Mechanics as Unified Manifestations of the Symmetry of Complexity", physics/0601140.

<http://arXiv.org/abs/physics/0510240>

Scheme of complex-dynamical universe structure:
two interacting, omnipresent protofields give rise to all particles and fields

Quantum Field Mechanics



Completion of the unreduced "double solution" of Louis de Broglie

COMPLEX-DYNAMICAL UNIVERSE

- *Physically real* origin, structure and dynamics of elementary particles and fields (quantum beat)
- *Causally complete* solution of “mysteries”: unreduced interaction complexity accounts for *unified* “quantum” and “relativistic” properties
- *Unification*: quantum, relativity, gravity, forces, particles, properties, laws → *symmetry of complexity*
- *Intrinsic emergence*: self-tuning, tangible universe in development → no dark matter/energy problems
- *Practical implications*: no abstract, fictitious entities (Higgs, hidden dimensions, super-symmetry, etc.), causal sufficiency of existing species & properties

REAL WORLD EXPLAINED AS IT IS, NOT A “MODEL”

IRREDUCIBLY COMPLEX DYNAMICS OF REAL NANOBIOSYSTEMS

Genuine quantum chaos, quantum measurement and classicality emergence

- **Chaoticity criterion is satisfied on the smallest scales**

$$\kappa \equiv \frac{\Delta \eta_i}{\Delta \eta_n} = \frac{\omega_\xi}{\omega_Q} \approx 1$$



fundamental nanoscience paradigm means essentially complex, chaotic dynamics

<http://arXiv.org/abs/physics/0412097>

- **Genuine quantum chaos by dynamic multivaluedness**
usual quantum chaos paradox is due to single-valued reduction

<http://arXiv.org/abs/quant-ph/9511034-6>

- **Complex dynamics of causal quantum measurement**
causal wave reduction and dynamically random eigenvalue choice

<http://arXiv.org/abs/quant-ph/9511037>

- **Dynamic classicality emergence (multivalued SOC)**
Classicality as higher complexity level (elementary bound system)

<http://arXiv.org/abs/quant-ph/9902016>

- **Causally complete, reliable nanoscience foundation**
Complex (multivalued) dynamics at the border of quantum chaos, causal quantum measurement and emerging (chaotic) classicality

<http://arXiv.org/abs/physics/0211071>