

**FROM THE END OF UNITARY SCIENCE PROJECTION
TO THE CAUSALLY COMPLETE COMPLEXITY SCIENCE:
EXTENDED MATHEMATICS, SOLVED PROBLEMS,
NEW ORGANISATION AND SUPERIOR PURPOSES**

ANDREI P. KIRILYUK

Metallic State Theory Department
Institute for Metal Physics, Kyiv, Ukraine

E-mail: *Andrei.Kirilyuk@Gmail.com*

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Abstract

The deep crisis in modern fundamental science development is ever more evident and openly recognised now even by mainstream, official science professionals and leaders. By no coincidence, it occurs in parallel to the world civilisation crisis and related global change processes, where the true power of unreduced scientific knowledge is just badly missing as the indispensable and unique tool for the emerging greater problem solution and further progress at a superior level of complex world dynamics. Here we reveal the mathematically exact reason for the crisis in conventional science, containing also the natural and unified problem solution in the form of well-specified extension of usual, artificially restricted paradigm. We show how that extended, now causally complete science content provides various “unsolvable” problem solutions and opens new development possibilities for both science and society, where the former plays the role of the main, direct driver for the latter. We outline the related qualitative changes in science organisation, practice and purposes, giving rise to the sustainability transition in the entire civilisation dynamics towards the well-specified superior level of its unreduced, now well understood and universally defined complexity.

As shown before (e. g. [1-12]), today's period of critical global changes [13-19] implies the *radical change of the role and quality of scientific knowledge*, from the traditional blind empirical search for potentially "useful" novelties in special disciplines of standard unitary science to the *causally complete* and *intrinsically unified* understanding of unreduced real-world complexity, in the entire diversity of its *dynamically emerging* levels, from fundamental physics (now without postulated "mysteries" and accumulating "hard" problems) to reliable civilisation and consciousness development.

A change of that scale, starting from the "end" (increasing stagnation and growing contradictions) of traditional, unitary science (see [20-24] and references therein), cannot occur just by "greater efforts" of the same kind and definitely asks for deep and well-specified revolutionary changes in science content, organisation, purposes and social role. Indeed, even apart from its glaring "end", the conventional, positivistic and unitary (dynamically single-valued) fundamental science has finally *failed* to initiate the promised "knowledge-based society", inserting itself instead in the modern huge machine of traditional, *profit-based society* as its minor professional component of vanishing popularity, which is also oriented to personal profits instead of knowledge progress and loses increasingly even that, shamefully miserable status (being replaced by technology, or purely applied science structures and interests). The necessary transition to genuine sustainability corresponds to a quite different kind of development *directly based on and guided by the rigorous, provably complete scientific understanding* of all its essential aspects and directions, realising thus what we call *reason-based, or conscious, society*, where the *new*, intrinsically creative, causally complete and totally consistent kind of scientifically objective knowledge of real-world complexity constitutes the *true basis of progress* and the *centre of natural social interest* [1-12,20].

This qualitative shift in the role of *truly* scientific, really *objective* knowledge should be based, first of all, on its essentially different, *dramatically extended content* and related entirely new paradigm, including methods, purposes, practices and results. The key difference between the unreduced, *dynamically multivalued* description of the *universal science of complexity* [1-12] and usual *dynamically single-valued*, effectively zero-dimensional (point-like) projection of standard unitary science (including its imitations of complexity) is the *rigorously specified extension* of that kind explaining both previous partial successes of unitary science and its modern deepening impasse, with the *growing number of unsolved problems*, despite all the huge technical efforts and extremely developed structure (still profiting from former successes).

In order to fully understand the difference between those two kinds of knowledge, which leads inevitably to the ultimate scientific revolution [20], we should take into account the accompanying historical key features of knowledge development [1], where the maximum possible simplification of reality within the dynamically single-valued paradigm of unitary science is closely related to the equally simplifying general approach of the dominating *positivistic empiricism* insisting, since Newtonian “*hypotheses non fingo*”, on the *exclusive effectiveness* of that huge simplification, with practically *forbidden* searches for causally complete, strongly “ontological” and truly consistent explanations. What matters in this approach is the formal correspondence between a subjectively chosen “main” part of observations and a proposed abstract “model”, with the underlying physical reasons for that correspondence, always remaining essential deviations, unsolvable “mysteries” and glaring contradictions between different “models” being left apart as unnecessary “philosophy” preserved sometimes only for its own sake, as a kind of luxury decoration on top of otherwise “perfect” formal “modelling”.¹ As further science development has shown (though quite definitely only today, after many centuries of “success”!), that illusive “perfection” of misleading unitary simplification inevitably ends up in stagnating old and increasingly growing new problems demonstrating the *unbreakable fundamental barrier*

¹ In that sense, the entire modern (official) science concept is not really different (contrary to its own statements) from the previous, millennia-old paradigm and method of Ptolemaic science related to internally similar religious kind of knowledge, where in all cases of modern scientific, Ptolemaic, or religious knowledge one deals with a number of ad hoc, fundamentally unprovable “postulates” accompanied by growing numbers of further inexplicable contradictions, in which one must simply “believe” because “it’s our best kind of knowledge” (by another subjectively imposed postulate).

for such ultimately simplified and formalised knowledge development. They are so remarkable and revealing, for example, those today's peaking and desperate efforts of unitary science to understand finally the true origin of gravity [25-27] (though always only in terms of purely abstract and strongly incomplete mathematical constructions!), so long after "successful" Newton's (and later Einstein's) positivistic theory, or those accumulating new mysteries of dark matter and energy, completing the plethora of stagnating old problems of unitary cosmology and astrophysics (see [4-6,12]).

Be it intuitive and ideological simplification of the imposed canonical positivism or more formalised simplicity of point-like, intrinsically predictable and "geometrically" smooth mathematical constructions, the critically growing "unsolvable" problems in science and society strongly point to its *badly needed qualitative extension* to the unreduced dynamic multivaluedness of tangible physical reality and the related qualitatively different search for the *totally consistent* explanations and *causally complete* knowledge content. And while the desperately outdated and intensely mystified unitary positivism always persists in its own artificial limitations, trying to profit from related "postmodern" word plays and fruitless cabbalistic symbolism, the ultimately extended and intrinsically realistic paradigm of fundamental dynamic multivaluedness of unreduced interaction processes demonstrates its natural power to solve those "unsolvable" unitary problems within the *naturally and totally unified* science framework [1-12,20,28-31], thus *confirming* previous important, but historically rejected causal approaches of e. g. René Descartes or Louis de Broglie (see [1,32]), despite their dramatic misunderstanding and simplification by the dominating unitary doctrine.

The *rigorous mathematical expression* of the qualitatively extended content of the universal science of complexity, so badly missing today in the unitary science framework, can be summarised as the *new mathematics of complexity* [1,2,5,7,8,12,20,28]:

(i) *Non-uniqueness* of any real problem solution, in the form of *fundamental dynamic multivaluedness (redundance)* of rigorously obtained, incompatible system realisations (its physically complete configurations), as opposed to conventional uniqueness theorems and solution type actually corresponding to the degenerate and unreal case of one-dimensional timeless interaction problem (the only truly "integrable", or "exactly solvable", one). Note the difference of our *dynamic*, interaction-driven multivaluedness from

usual, formally multivalued functions or various unitary imitations of “multistability” within the single time-dependent solution (describing system state or trajectory). The property of fundamental dynamic redundance becomes evident in the formally equivalent *effective expression* of the initial interaction problem formulation [1-12], where the latter, if understood directly, by the straightforward single-valued extension of one-dimensional (integrable) problem formulation, lacks the omnipresent and evident dynamic instabilities of unreduced, full-dimensional interaction dynamics (which explains the deficiency of usual uniqueness conjectures).

(ii) Omnipresent genuine and purely *dynamic*, universally defined *randomness* and *probability* due to the inevitable change of equally real, but incompatible realisations in *causally random* order, providing also clear understanding and qualitative extension of usual vague notions of nonintegrability, nonseparability, noncomputability, uncertainty (indeterminacy), probability, undecidability, stochasticity, broken symmetry, free will, etc., with crucially important consequences for practically all real-world applications, otherwise heavily misled by arbitrary unitary guesses [1-3,12,28]. *Truly* regular structures, motions and patterns are strictly *absent* in the real-world content (being replaced by the multivalued SOC regime of externally ordered, but internally chaotic dynamics), while they exclusively prevail in traditional mathematical framework and way of thinking, including its dynamically single-valued *imitations* of randomness and chaoticity.

(iii) The *absence of self-identity*, $\mathfrak{A} = \mathfrak{A}$, for any real structure \mathfrak{A} , tacitly assumed in traditional mathematics. In the real world and its new mathematics of complexity we have instead $\mathfrak{A} \neq \mathfrak{A}$, which provides the unified origin and rigorous definition of *permanent, naturally irreversible change, event* (of realisation change), *emergence* and *causal, physically real and multilevel time flow* [1-12,29].

(iv) Fractally structured multivalued *dynamic entanglement* of interacting system components in the unreduced problem solution [1-12], providing the *rigorous* mathematical definition of the perceived tangible *quality* (or texture) of emerging structures, as opposed to purely abstract, “immaterial” character of usual mathematical structures and models.

(v) *Dynamic discreteness*, or *causal quantisation*, of unreduced interaction results (in the form of realisations) and dynamics (and thus any real

structure and process), eventually due to its *holistic* character, where everything interacts with everything else, resulting in the omnipresent *dynamic instability* that gives rise to qualitatively inhomogeneous, *nonunitary* system evolution, with the opposite fundamental unitarity of traditional, dynamically single-valued mathematical framework.

One should add to these main features of the new mathematics of complexity its dynamically and globally *unified* character expressed by its *single, unified structure of dynamically probabilistic fractal* (essentially extending the notion of usual fractals) and *single, unified law of the universal symmetry of complexity* [1-12,28-31], which give rise to the dynamically unified variety of all world's structures, objects, dynamic regimes, (properly extended) laws and principles. In particular, one obtains the *naturally unified* and causally complete picture of reality at the *fundamental, lowest complexity levels of elementary particles and fields*, where this unification, so definitely missing in the unitary theory framework (see e. g. [33-35]), includes the causally specified *complex-dynamic origin* of particles and fields, their properties, fundamental interaction forces and constants, quantum and relativistic behaviour [1,3-6,12].

We see, therefore, that the power to *solve problems*, including stagnating, growing and “unsolvable” ones within the unitary science framework, comes together with the “general” consistency properties, such as completeness (total absence of contradictions and gaps), causality (the well-specified origin of all observed phenomena and structures), physical realism and unification. We show in the universal science of complexity that the persistent absence of these properties and the growing number of “unsolvable” problems in the standard, unitary science paradigm are specifically related to the *strong artificial limitations* of the latter to the *minimum* number of *only one* system realisation, while the remaining huge numbers of all realisations of any real system (starting already from the elementary particles) are unconditionally disregarded, just by the dominating positivistic simplification considered as undeniable advantage. Therefore all popular modern discussions of the “limits of science” originating in the accumulating evident failures of just that, *very special* kind of science (the dynamically single-valued, or unitary science) actually refer to the fundamental limits of *only that*, very rough approximation and its ultimately simplified, desperately abstract picture of

reality.² By contrast, the intrinsically complete knowledge extension to the complex, dynamically multivalued result of any real interaction process has no such limits and can provide the *totally consistent solution to any real problem*, as confirmed by very diverse applications of the universal science of complexity [1-12,20,28-31]. While unitary science schemes can still show certain (but always limited) efficiency for cases of externally quasi-regular behaviour (roughly corresponding to the multivalued SOC limit of complex dynamics [1-12]), they naturally break down there, where the unreduced, dynamically multivalued and thus fundamentally chaotic origin of reality appears in more explicit forms of directly nonunitary, multivalued behaviour or cumulative properties resulting from the underlying chaotic dynamics (like mass, “quantum” or “relativistic” behaviour, etc. [1,3-6]).

As this fundamental failure of unitary science doctrine coincides today with the huge, apparently “unlimited” power of empirical technologies, it tries to compensate its internal cognitive deficiency by that massively used technological power, in particular in the form of *scientific mega-projects* with the announced “ambitious”, if not “magic”, purposes of great discoveries and applications. One can recall here the LHC and other, ever more powerful particle accelerators and detectors often comparable to big and super-expensive factories, gravitational-wave detectors (including the LIGO project), nanotechnology projects, quantum computers, various brain study mega-projects, numerous genetic enterprises, exploding “big data” initiatives, “climate change” simulations and “geoengineering” plots, etc. While their mega-promises and doubtful “successes” serve to justify their giga-budgets, the *severely limited unitary scientific basis* they continue to use can only give rise to misleading, if not catastrophic or fraudulent, results compromising *all* fundamental science development [1,20].

This is the case of the Nobel Prize-winning Higgs boson concept and announced victorious discovery at the LHC accelerator, suffering from

² In particular, popular references of unitary science doctrine to the “*Gödel incompleteness theorem*” from unitary arithmetic, as a “strong” justification of intrinsic general limits of science, its “mysteries” and “unsolvable” problems, represents but a *logical vicious circle*, where similar to conventional “uniqueness theorems”, one obtains just those limits that were explicitly (though often tacitly) inserted from the beginning. It is enough to go out of those artificial unitary limitations towards the unreduced, dynamically multivalued reality of hierarchically organised and permanently changing levels of unreduced dynamic complexity to see that knowledge of every complexity level can be perfectly (causally) complete as such, while the global knowledge “incompleteness” appears only as the trivial absence of (empirical) interaction data and corresponding theoretical understanding of yet inaccessible complexity levels and objects or as occasional links to entities from new, emerging levels of reality [1].

glaring inconsistencies and still accepted as the unique possible explanation of experimental results, despite the alternative *causally complete* interpretation of the universal science of complexity [1,3-6,36,37]. Equally huge efforts and mega-projects were dedicated to verification and development of other dubious unitary science concepts, such as various aspects of the heavily incomplete Standard Model of particle physics or its now obviously failing string-theory extension, as well as the Big Bang cosmology, including the search for hidden extra-dimensions or various “theoretically needed” particle species. And although respective problems of fundamental physics are successfully resolved in the extended framework of dynamic multivaluedness paradigm, without any redundant entities, the intrinsically inconsistent mega-projects of unitary physics, transformed into a technically powerful industry, always progress in their knowledge destruction activity, contributing to the end-of-science postmodern philosophy yet amplifying the impasse, and so on. Moreover, big monetary prizes quickly growing in number and financial values (always trying to exceed the amount of the Nobel Prize, also scientifically devaluated) are attributed to those fruitless research results of unitary science, even when they are recognised as misleading and failing in their quest!

Another scandalously “successful” and heavily hyped mega-project of unitary fundamental science is the announced *gravitational-wave detection* by the LIGO system of detectors (also “confirmed” by the 2017 Nobel Prize). As noted elsewhere [1,3-6,12], the possibility of existence itself of real, long-distance gravitational waves, only formally resulting from the abstract general relativity framework, leads to essential contradictions within our (but actually *any*) reality-based picture consistently confirmed by all other observations. It is not difficult to see the universality of these objections, including *any physically real* origin of gravity (absent in usual theory) and the related wave propagation in a material medium. If such propagation occurs over very large distances from the source of the registered gravitational waves [38] (as it should typically be the case for their observations), then the inevitable effects of dissipativity and dispersion should influence essentially the original signal shape, in contradiction to the reported coincidence between the calculated initial event shape and its very similar and distinct replica registered at an extremely remote location on Earth, after all interactions throughout billions of light years of distance containing numerous

perturbations of even initially ideal transmitting medium.³ In addition to other emerging doubts [39,40], these fundamental contradictions demonstrate once again that purely subjective desire (cf. [41]) to reaffirm the missing unitary science consistency by purely technological efforts can easily exceed the universal demands of elementary scientific objectivity and honesty.

The quantity of similar, acknowledged or unacknowledged, mega-project failures in physics alone is big, with no real progress in true discoveries and problem solutions for decades, despite huge technical and human resources involved. As a result of this recently emerging degradation, we have now a qualitatively new situation, where the number of various “extremely difficult”, practically unsolvable fundamental problems of real-world structure and dynamics has started again to *grow* rapidly, as it was once the case before and within previous scientific revolutions. The situation is not really better in externally more prosperous fields of nanoscience, genetics, or brain science, with similar mega-project failures or only formal, data-accumulation results (with the characteristically arrogant emphasis on computer-generated senseless, statistically simple, but *big*, very big data)... The related proportion of variously false results also grows dramatically, especially for high-complexity studied objects, approaching sometimes 100 % [42]. All those numerous facts from different research fields reveal an underlying fundamental problem, actually converging, as shown above, on the unitary science limits and inconsistency naturally *disappearing after extension* to the unreduced, dynamically multivalued science of complexity. This variously confirmed conclusion emphasizes the urgent need to *seriously reform* the conventional science method and in particular its modern practice of very big, but totally misleading projects having no chances of success from the beginning (but consuming huge amounts of resources and public interest in science, turning inevitably into growing disappointment). Any sensible research with minimum expected efficiency can only be based on intrinsically creative, totally

³ Another contradictory feature of this officially successful mega-project is the reported coincidence of the speed of gravitational wave propagation with the speed of light, used for the correlated-event confirmation of gravitational wave registration by spatially distant detector branches on Earth [38]. However, the very different physical nature of e/m and gravitational waves and their propagation media (in *any* physically realistic description, including our e/m and gravitational protofield properties) excludes the possibility of such coincidence of their propagation velocities (irrespective of purely abstract and postulated Einstein’s equations). And since the propagation speed for the registered signals was confirmed as the speed of light, one should deduce that these signals of rather common shapes can only have the e/m origin (with either cosmological or much closer sources).

causal and realistic approaches ordered according to their *objective consistency* instead of the fixed and totally subjective “high status” of a single, postulated and abstract theory or concept in the now dominating practice of unitary science. The resulting changes in high-energy physics projects will involve, for example, much more causal, real-complexity-driven research programme within the already attained, *objectively quite sufficient* energy range, instead of the dominating dangerously blind and objectively vain search in ever higher energy ranges, in favour of obviously contradictory, arbitrary and purely abstract mathematical guesses [1,5,6,12,36,37].

The case of failing mega-projects of unitary science demonstrates the underlying problem of this traditional research *organisation* closely related to its artificially limited (dynamically single-valued) content, where every particular point-like projection of unreduced, dynamically multivalued reality (remaining hidden) can only be subjectively imposed against other, equally limited and necessarily abstract projections (for example, nonlocal quantum “waves”, “fields” and “strings” against localised “particles”, quantum gravity “loops” and “spin networks”). In the necessary new, qualitatively different and intrinsically creative organisation of unreduced, causally complete science (of complexity) one must always deal with a *free comparison* of different (*all* professionally available) approaches and tentative *consistent* solutions to a problem (e. g. within a planned big experimental project), where all the results will be used and supported *exclusively according to their objectively proved consistency*, with *all* reasonable approaches being openly presented and available for further discussion. One can compare this to the modern practice of usually only one, very contradictory theoretical concept chosen for its extremely resource-consuming experimental verification or realisation within a huge experimental mega-project (like Higgs boson or supersymmetry at the LHC, dark-matter species, gravitational waves, Big Bang cosmology experiments, unitary quantum computers, etc.).

The entire centralised, subjective, self-estimating, therefore deeply corrupt and as a result totally inefficient and fruitless organisation of modern science (see e. g. [24,43] and references therein) should be replaced by a qualitatively new organisation of superior complexity level, in the form of *free (intellectual) market of competing small, independent, but highly interactive scientific enterprises and their results* [20]. The emergent, free-interaction structure of this organisation ensures open and most efficient generation of

new ideas and problem solutions, where now *truly independent* scientists (and their changing, freely organised teams) perform *only creative research work*, while searches for support and application are performed by separate independent professionals, interacting with equally independent, different and competing sources of support, all of them estimated exclusively by *successful problem solutions and discoveries* realised by their direct individual participation. No corrupt subjective self-estimation networks of unitary science organisation (its modern “peer-review” system) will be possible at this superior-complexity organisation level, corresponding to the new, causally complete knowledge content and the new level of tasks in today’s globalised world above the complexity threshold (see [9-12]).

In particular, there is the important correlation between this superior level of science organisation and superior-complexity structure of social organisation and governance, the Harmonical System, emerging above the complexity threshold as a result of complexity, or sustainability, transition. It corresponds to the *new social role of science* as the *direct basis* of intrinsically efficient governance and provably sustainable development in the reason-based society, as opposed to the profit-based technical assistance and blind, totally inefficient search for occasional novelties at the modern level of outdated, but still dominating Unitary System [1,9-12,44]. This *unified*, superior-level system of the new, causally complete science content, its new, creation-based organisation, and new social role of the main driver of truly sustainable development is the purpose of the forthcoming *last and ultimate scientific revolution* [20].

The universal “new old” *criterion of truth* at this superior reason-based development level can only be the *total consistency* of the proposed problem solution and progress directions based on the *causally complete* understanding of unreduced interaction processes definitely liberated from unavoidable “dark matters”, postulated “mysteries” and cultivated “paradoxes” of oversimplified unitary knowledge projections. The inevitable novelty of the unknown exists now in the form of emerging new complexity levels or objects constituting always renewed research and progress directions, while the already well-known structure dynamics *cannot* contain any “objective” mysteries, persistent “unsolvable” problems and other “limits of science” originating, in the traditional unitary science framework, only within its own, artificial limitations of dynamically single-valued projection of reality.

We see thus that the proposed new level of *truly* rigorous, causally complete and intrinsically unified science development not only leads to real problem solutions and further essential progress in applications, but contributes as the main guiding mechanism to the *superior purpose* of entropy-complexity development beyond the attained levels of life and consciousness [1,2,9-11], with the essential role and genuine novelty of the *edge research* agenda [12]. This giant paradigm leap of the last scientific revolution from the modern unitary science role of a limited technology servant, the more and more submerged into its own accumulating contradictions and unsolved problems and therefore losing any public interest, to the *omnipotent basis of efficiently guided human progress* at superior complexity levels demonstrates the extremely high stakes of the emerging *complexity revolution* as the unique and now *critically important* way towards the rigorously specified purpose of all previous and future civilisation development.

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