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Extended Abstract

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The new universe and the singularity of mankind

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A century ago Alexander Friedman and Georges Lemaitre posed the foundations of what we now call the "Big Bang Theory" and thus provoked a revolution in understanding our universe, its origin, its evolution. Together with our knowledge of the infinitely large, our knowledge of the infinitely small has also experienced a revolution. Ever since the beginning of the modern era in the seventeenth century, mankind has never experienced such a dizzying philosophical situation. While pursuing scientific research, we must be concerned about their consequences, not just in the field of techniques, in other words in relation to their ethical issues. We must also take the measure of the anthropological upheaval caused by the progress of our knowledge in science, and develop a new humanism which, without excess, offers to mankind the singularity and responsibilities conferred by the place it occupies within the universe.

Nature's myriad complex systems—whether physical, biological or cultural—are mere islands of organization within increasingly disordered seas of surrounding chaos. Energy is a principal driver of the rising complexity of all such systems within the expanding, ever-changing Universe; indeed energy is as central to life, society, and machines as it is to stars and galaxies. Energy flow concentration—in contrast to information content and negentropy production—is a useful quantitative metric to gauge relative degree of complexity among widely diverse systems in the one and only Universe known. In particular, energy rate densities for human brains, society collectively, and our technical devices have now become numerically comparable as the most complex systems on Earth. Accelerating change is supported by a wealth of data, yet the approaching technological singularity of 21st-century cultural evolution is neither more nor less significant than many other earlier singularities as physical and biological evolution proceeded along an undirectional and unpredictable path of more inclusive cosmic evolution, from big bang to humankind. Evolution, broadly construed, has become a powerful unifying concept in all of science, providing a comprehensive worldview for the new millennium—yet there is no reason to claim that the next evolutionary leap forward beyond sentient beings and their amazing gadgets will be any more important than the past emergence of increasingly intricate complex systems. Nor is new science (beyond non-equilibrium thermodynamics) necessarily needed to describe cosmic evolution's interdisciplinary milestones at a deep and empirical level. Humans, our tools, and their impending messy interaction possibly mask a Platonic simplicity that undergirds the emergence and growth of complexity among the many varied systems in the material Universe, including galaxies, stars, planets, life, society, and machines. Cosmic evolution is more than a subjective, qualitative narration of one unrelated event after another from big bang to humankind. This extensive scientific scenario provides an objective, quantitative framework that supports much of what comprises material Nature. It addresses the coupled topics of system change and rising complexity—the temporal advance of the former having apparently led to the spatial growth of the latter, yet the latter feeding back to make the former increasingly productive. It implies that basic differences both within and among the many varied complex systems in the Universe are of degree, not of kind. And it contends that evolution, broadly construed, is a universal concept, indeed a unifying principle throughout modern science. More than perhaps any other single factor, energy plays a central role throughout the physical, biological, and cultural sciences. Energy seems to be an underlying, universal driver like no other in the evolution of all things, serving as a common currency in the potential unification of much of what is actually observed in Nature. Energy rate density, in particular, is an unambiguous, weighted measure of energy flow, enabling assessment of all complex systems in like manner— one that gauges how over the course of natural history writ large some systems optimally commanded energy and survived, while others apparently could not and did not. Human society and its invented machines are among the most energy-rich systems known, hence plausibly the most complex yet encountered in the Universe. Cultural innovations, bolstered by increased energy allocation as numerically tracked by rising Φm values, enable 21stcentury H. sapiens not only to circumvent the degrading environment on Earth but also to challenge it, indeed manipulate it. Technological civilization and its essential energy usage arguably act as catalysts, speeding the course of cultural change, which like all of cosmic evolution itself is unceasing, uncaring, and unpredictable. Whatever our future portends—whether a whole new phase of cosmic evolution or merely the next, gradual step in cultural evolution, be it complex survival or simple termination—it will be a normal, natural outcome of cosmic evolution itself. For humanity, too, is part of Nature—and however humbling, we are likely just another chapter in a meta-story yet unfinished.

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