



# Beyond Duality

## Our In-formed and Holographic Universe

*Dr Jude Currivan*

*This article argues that the 20th century scientific revolution was incomplete. Science has overlooked the significance of information and consciousness which need to be incorporated in a more comprehensive view of reality and which naturally reconciles quantum and relativity theories.*

### Completing the 20<sup>th</sup> century scientific revolution

Although the scientific revolution of the 20<sup>th</sup> century expanded and replaced the previous Newtonian ideas of a Universe of things and absolute space and time with interactions of energy fields, quantum probabilities and relativities, it was an incomplete revolution in overlooking the significance of information and the inclusion of consciousness.

As these are being increasingly viewed as crucial to our understanding of reality, we are now on the threshold, not only of a further scientific revolution, but even perhaps a revolution in the way we view ourselves and the entire Cosmos.

Recent discoveries, experimental evidence and theoretical insights across all scales from the tiniest to the entirety of our Universe and numerous fields of research ranging from physics, cosmology, information theory and complex systems to biology, human-made structures and social behaviours are accumulating and converging.

To paraphrase Hermann Minkowski, who pioneered our 20<sup>th</sup> century geometrical and relativistic understanding of space and time and update his insights for this widening perception: henceforth space-time by itself and energy-matter by itself are doomed to fade away into mere shadows, and only a kind of union of the two will preserve an independent reality. Information is being seen as offering this union; underpinning, pervading and literally in-forming the formation of physical reality.

Just as the informational description of any physical object, interaction and process can be formulated as the digitised bits of information in our technologies, such informational bits, not as random data, but combined as patterned and relational in-formation are being discovered to comprise the foundation and all-pervasive nature of our Universe. Moreover, mounting evidence is demonstrating that from dynamic

in-formational patterns embedded on a holographic boundary and initiated from deeper non-physical realms, our entire Universe arises, exists and evolves as a unified entity.

### Information is real

Despite its appearance of solidity, physicists know when drilling down to sub-atomic scales that matter is extremely ephemeral. Its will-o'-the-wisp nature shows our Universe is essentially more than 99.9% no-thingness and where material entities, rather than embodying any solidity, instead have been shown to be merely excitations within energetic fields.

They also know that, whilst within space and time, no signal can go faster than the speed of light, Bell's theorem, named after physicist John Stewart Bell shows mathematically that quantum mechanics can only work if the whole Universe is also nonlocally interconnected as a single entity. Such nonlocal and universal coherence has now been experimentally proven in laboratories on macroscopic scales<sup>1</sup> and astronomically for distances of at least 600 light years from Earth<sup>2</sup>.

However, given our everyday experiences of the apparent solidity of the physical world and the seeming separations between large-scale objects, such evidence of its truly ephemeral nature and fundamental interconnectedness has looked to have little relevance for most of us. This may be about to change.

In 2012 an experiment led by physicists Antoine Bérut and Eric Lutz<sup>3</sup> demonstrated that when a digital bit of information is deleted, actual physical heat is released and in line with theoretical predictions.

This experiment validates an initial insight by communications expert Claude Shannon and later expanded on by information theorist Vlatko Vedral<sup>4</sup> that the entropy of a system, previously considered as its level of order and disorder, is better understood as being the measure of its information content. The experiment proved the links between

information and physical concepts of heat, work and entropy.

From these and other discoveries, extraordinary though it might seem, an increasing number of physicists are coming to consider that the digitised information, that is the basis for all our technologies, is exactly the same as universal information, also articulated as digitised bits, that underpins and literally makes up all physical reality. Leading-edge scientific research is discovering and coming to realise that our high-tech virtual realities and holograms are children's toys for which the appearance of our Universe is the master class.

## The cosmic hologram

The patterned information, or in-formation that in-forms all physical reality does so at a fundamental scale that naturally emerges when all the forces of our Universe are combined. This so-called Planck scale for energy, matter, space and time is equivalent in terms of space and time to an almost unimaginably tiny length of around  $10^{-35}$  metres and a time duration of approximately  $10^{-44}$  seconds respectively.

To understand how the Planck scale relates to the informational attributes of physical reality, we need though to consider a further extreme phenomenon of our Universe; black holes. Studies of black holes show that the information describing their physical properties, their so-called informational entropy, isn't proportional to their three-dimensional volumes. Instead and acting exactly like a hologram, it varies in relation to their two-dimensional spherical surface areas, or event horizons.

If we imagine the surface areas of such event horizons to be covered in tiny triangles at the Planck scale, every minuscule Planck area stores one bit of information at this minute pixelation of space-time. Extending this insight from black holes to our entire Universe, as the so-called holographic principle, then shows that physical reality isn't just inherently in-formed but holographically manifested.

In bringing together these two profound perceptions of an in-formed and holographic Universe, literally as a cosmic hologram, scientists are beginning to restate and expand the laws of physics as informational algorithms. Just like those that instruct our computers to operate, these fundamental laws are now being understood as instructing our entire Universe how to do so.

The latest cosmological evidence strongly posits that our Universe is finite; born 13.8 billion years ago, but not with a chaotic big bang, but in an exquisitely ordered and finely-tuned Big Breath and as what's called a closed system. From these and other discoveries and insights it's becoming ever clearer that energy-matter and space-time are phenomena that emerge from and which are complementary expressions of such universal information.

## Thermodynamics to infodynamics

There are certain key aspects of our Universe and one key premise that are pointing the way to not only restate and expand the laws of thermodynamics in informational terms but suggesting how, by doing so, quantum and relativity theories, might be reconciled.

The key aspects, supported by cosmological evidence, are that spatially our Universe is geometrically flat and that it is both finite and closed in space-time. And, as we have seen, both theoretically and experimentally, information has been proven to be physically real.

The key premise, supported by a theoretical framework and progressively by evidence, as we shall see, at all scales of physical existence, is that not only is our Universe informationally based but also holographically manifested

These key aspects and premise, I propose, enable the expansion of the laws of thermodynamics, designated by Ludwig Boltzmann in the 19<sup>th</sup> century to describe the behaviour of gases, as laws of information or infodynamics.

The first law of thermodynamics states that the energy of a closed system is always conserved. Expanding this to our entire Universe, taking account, as quantum theory does, that energy and matter are equivalent and finally understanding that information can be expressed as energy-matter leads to a restatement of the first law as: *information expressed as the energy-matter of our Universe is always conserved.*

The second law of thermodynamics states that the entropy of a closed system always increases. Boltzmann described entropy in terms of the number of microstates of a system. We have seen though, how, thanks to information theory, the notion of entropy can be restated to describe the information content of a system. Whilst entropy has hitherto been commonly thought of in terms of order trending to disorder, now from an informational viewpoint and considering it for the Universe as a whole, it is coming to be considered in terms of simplicity evolving to complexity.

Given the extraordinarily ordered and simplest state that cosmologists have discovered prevailed at the birth of our Universe, also means that the entirety of space-time at its first moment embodied its minimum informational entropy.

The second law can then be restated as: *the total informational entropy of our Universe always increases over space-time.*

Including the premise of the holographic principle, that each Planck area of the holographic boundary of our Universe embeds one bit of information, the continually increasing entropic flow of

information within space-time means that from that first moment space *must* expand and the arrow of time *must* flow for the space-time of our Universe to express ever more information. Indeed, I suggest that the nature of time itself may now be comprehended as the ever-increasing accumulation of the evolutionary and experiential information of our Universe.

The two laws of infodynamics indicate an understanding that energy-matter and space-time are complementary expressions of information; the first enabling our Universe to exist and the second enabling it to evolve as a finite and unified entity within an infinite and eternal Cosmos.

Recognising that quantum and relativity theories deal respectively with the existence of energy-matter and the evolution of space-time, the resultant laws of information I would advocate, are then able to also support and indicate a natural reconciliation of these two pillars of 20th century science.

## Universal geometries

The ancient understanding that universal geometric relationships underpin all physical phenomena, is also now being validated. Instead though of idealised patterns, computer analyses of vast amounts of data make it possible to uncover these in-formational and holographic templates as fragmented dimensional and self-similar shapes termed fractals that holographically scale up and scale down throughout universal phenomena.

They arise from dynamic in-formational basins called attractors in the complex plane of phase space, which is being increasingly understood as an actual nonphysical domain of reality; rather than merely the mathematical realm on which virtually all fundamental laws of physics are based.

From individual atoms<sup>7</sup> to the scale of vast galactic clusters<sup>8</sup>, examples of such attractor-based, fractally realised patterns abound. On our planetary level, instances of such innate in-formational patterns so far investigated range from geology and geophysics (coastlines, topographical features, tectonic plates, river drainage systems, sizes of mountains within ranges); meteorology (clouds, lightning cascades, snowflakes) to chemical processes (corrosion).

## Holographic behaviours

Crucially, however, the signature of the cosmic hologram is not only being discovered throughout the so-called natural world but also in our collective human behaviours.

Examples of such correlations investigated to date include movements of stock market prices by the 'father of fractals' Benoit Mandelbrot; internet traffic, website links and data routes<sup>7,8,9</sup> email, snail mail and social internet group communications and web browsing<sup>10,11,12</sup>, geographic and time-based usage of mobile phones and over time<sup>13</sup>

and characteristics of so-called small world networks<sup>14</sup>, first studied by social psychologist Stanley Milgram in the 1960s.

In 2015, astrophysicists Henry Lin and Abraham Loeb at Harvard tracked how by looking at their population densities, respectively people and stars, cities grow in the same in-formational ways that galaxies evolve<sup>15</sup>.

Many researchers are also discovering how dynamic in-formational forms pervade ecosystems and guide and pre-dispose evolutionary processes; seeing too how they are identical to the in-formational structures of the internet and our complex social behaviours.

Researchers Lewis Richardson in the 1940s and recently Neil Johnson and his team at the University of Miami have even uncovered how the in-formational relationships that link the relative frequencies and destructive powers of earthquakes are the same as those that plot the occurrences and scales of fatalities of human conflicts.

Such wide-ranging discoveries are showing both the 'me' of our individual uniqueness and the diverse yet fundamentally interconnectedness of the 'we'; not only of humanity but the entirety of our Universe.

## Beyond duality

Invariant space-time allied with universal nonlocality ensures that our Universe exists and evolves as a coherent and unified entity. Whilst within space-time, the speed of massless entities such as photons of light is a universal limit to the flow of information, thereby preserving causality, the innate nonlocality of our Universe enables it to simultaneously 'observe' itself existing and evolving universally and at all scales of existence.

At their most fundamental level, the increasing discoveries and insights that our Universe is innately in-formed and holographically manifest and the expanded awareness it provokes, raise profound questions of the nature of reality itself and crucially of the meaning of consciousness.

Philosopher David Chalmers's famous 'hard' question of how mind arises from materiality may now be able to be resolved by the progressive proof that mind *is* matter and matter *is* mind, and thus there is no such duality. Essentially, the increasing evidence is that consciousness isn't something we have but what we and the whole world are.

From its simplest Planck scale pixelation, digitised information arranges into dynamic, patterned and relational in-formation, with simplicity evolving to complexity and emergent self-awareness.

With such a developing perspective of the unified nature of reality, we are in the embryonic stage of a 21<sup>st</sup> century

scientifically-based revolution that offers the potential of reconciling with universal spiritual experiences, supernormal phenomena and explorations of consciousness to reveal that *all* we call reality is the ultimate unity of cosmic mind expressing, exploring, experiencing and evolving at all scales of existence. It is progressively offering compelling evidence that we are microcosmic co-creators of the realities of our Universe that exists and evolves as an integral and finite entity, perhaps one of many, within the infinite and eternal oneness of the Cosmos.

What if we collectively begin to understand, experience and ultimately embody the awareness of unified reality, and so are empowered to live more and more consciously in harmony with its inherent oneness and evolutionary impulse of ever-greater self-awareness?

What if we, as a species, are able to acknowledge that it has been the limitations of our duality-based perceptions which have primarily driven the conflicts, inequalities and exclusions of our fear-based behaviours?

What if, instead of continuing to fall into fear, humanity can come together to leap into love?

What if by re-memembering who we really are and *knowing* rather than hoping that we are each microcosmic co-creators of its unified reality empowers us to celebrate both the me of our individual uniqueness and the we of our collective diversity and harness our communal wisdom to transform our current global emergency into the emergence of our conscious evolution?

What then?

Based on *The Cosmic Hologram: In-formation at the Center of Creation* by Jude Currivan (Inner Traditions, 2017)

Dr Jude Currivan is a cosmologist, planetary healer, futurist and international author. She has a Masters Degree in Physics from Oxford University, specialising in quantum physics and cosmology, and a PhD in Archaeology researching ancient cosmologies from the University of Reading in the UK. Her work integrates leading edge science, consciousness research and universal wisdom teachings into a wholeworld-view aiming to raise awareness and empower resolutions to global challenges. [www.judecurrivan.com](http://www.judecurrivan.com)

Jude will be the speaker at Frenchman's Cove in February 2018 – see advert on inside front cover.

## References

1. Lee, K. C., Sprague, M. R., Sussman, B. J., Nunn, J., Langford, N. K., Jin, X. M., Champion, T., Michelberger, P., Reim, K. F., England, D., Jaksch, D. and Walmsley, I. A. *Entangling macroscopic diamonds at room temperature*. Science. 334(6060):1253-6. doi: 10.1126/science.1211914 (2011)
2. [http://web.mit.edu/asf/www/Press/Hartwig\\_Vienna\\_2017.pdf](http://web.mit.edu/asf/www/Press/Hartwig_Vienna_2017.pdf) (2017).
3. Bérut, A., Arakelyan, A., Petrosyan, A., Ciliberto, S., Dillenschneider, R. and Lutz, E. *Experimental verification of Landauer's principle linking information and thermodynamics*. Nature, 483, 187-189 (2012). Science. 334(6060):12536. doi: 10.1126/science.1211914 (2011).
4. Vedral, V. *Decoding Reality - the universe as quantum information*. Oxford University Press (2010).
5. "Fractal Patterns Spotted in the Quantum Realm," Physics World online (February 9, 2010), <http://physicsworld.com/cws/article/news/2010/feb/09/fractal-patterns-spotted-in-the-quantum-realm>.
6. International Centre for Radio Astronomy Research, "WiggleZ Confirms the Big Picture of the Universe," (2012) [www.icrar.org/news/news\\_items/media-releases/wigglez-confirms-the-big-picture-of-the-universe](http://www.icrar.org/news/news_items/media-releases/wigglez-confirms-the-big-picture-of-the-universe).
7. Willinger, W. and Paxson, V. *Where Mathematics Meets the Internet*. Notices of the American Mathematical Society, 45, 961-970 (1998).
8. Albert, R., Jeong, H. and Barabási, A-L. *The Diameter of the WWW*. Nature 401 (6749): 130-31. arXiv:cond-mat/9907038. Bibcode:1999Natur.401..130A. doi:10.1038/43601 (1999).
9. Faloutsos, M., Faloutsos, P. and Faloutsos, C. *Power-laws of the Internet*. Technical Report UCR-CS-99-01. University of California, Riverside. (1999).
10. Barabási, A-L. and Oliveira, J. G. <http://www.nature.com/nature/journal/v437/n7063/abs/4371251a.html> (2005).
11. Dezső, Z., Almaas, E., Lukács, A., Rácz, B., Szakadát, I. and Barabási, A-L. *Dynamics of information access on the web*. Physical Review 73, 066132 (2006).
12. Rybski, D., Buldyrev, S. V., Havlin, S., Lilijeros, F. and Makse, H. A. *Scaling laws of human interaction activity*. <http://www.pnas.org/content/106/31/12640.abstract> (2009).
13. Song, C., Qu, Z., Blumm, N. and Barabási, A-L. *Limits of predictability in human mobility*. Science.327(5968):1018-21. doi: 10.1126/science.1177170 (19 Feb 2010).
14. Watts, D. J. and Strogatz, S. H. *Collective dynamics of 'small-world' networks*. Nature 393, 440-442 doi:10.1038/30918 (1998).
15. Lin, H. and Loeb, A. <https://www.technologyreview.com/s/534251/astrophysicists-prove-that-cities-on-earth-grow-in-the-same-way-as-galaxies-in-space/> (2015).