

Starlight, Starbright: Are Stars Conscious?

Starlight, Starbright: Are Stars Conscious?

GREG MATLOFF AND C BANGS

CP
Curtis Press

Starlight, Starbright: Are Stars Conscious?
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Dedication

This volume is dedicated to the memory of three extraordinary people. Each in his own way was instrumental in providing a framework for the ideas explored here. First, here's to Olaf Stapledon! In *Star Maker* and other novels, he brought the concept of stellar consciousness to a wide audience. Next, we remember Arthur C. Clarke for his contributions in making the Universe in all its vastness and wonder accessible to the entire world. Finally, we will never forget Evan Harris Walker for his pioneering studies in the physics of consciousness, his friendship and support.

Preface

There are many published books dealing with the phenomenon of consciousness. Indeed, it may be the most thought about and discussed topic of all. Although our own consciousness is perhaps the only thing we can be absolutely certain of, it is paradoxically a very difficult concept to define.

I have nothing to add to the age-old efforts to explain consciousness. But in this book I explore the possibility that whatever it is, it may be present in other entities as well as in organic life—namely, the stars.

Other books have been published over the centuries to explore the possibility of stellar consciousness. But many of these have been authored from the point of view of Revealed Knowledge. Others have approached the concept of conscious stars from the direction of Deductive Knowledge. Although this book refers to stellar consciousness in myth, poetry and literature, it is primarily concerned with application of the scientific approach.

The reader will note that this book is divided into four parts. Those interested in ancient myths and traditions related to the concept of stellar consciousness may be most interested in “Part I: Ancient nights.” Those who follow the progress of quantum consciousness theory may concentrate on “Part II: Of neurons, tubules, and molecules” and the final chapter. Readers with a literary interest might concentrate on “Part III: Fictional bright stars” and the final chapter. Those interested in observational evidence might start with “Part IV: The astronomer’s search.”

As the reader may recall, the source of Revealed Knowledge is either direct contact with some deity or the human unconscious. Deductive knowledge is the result of rigorous logic. Although deduction is necessary in science for the construction of hypotheses, experimental or observational inductive tests are required before these constructs can emerge as successful theories. No claim is made here that all knowledge must be inductively testable in scientific terms. But since I am a scientist, I prefer to approach phenomena from a scientific viewpoint.

I was led to propose conscious stars in 2011 as a scientific hypothesis in response to the ongoing crisis of dark matter in astrophysics, as is discussed in the “Introduction.” Gravity theory seems to require a large amount of unseen matter to explain the motions of very distant stars and galaxies. But all attempts to locate this material have failed.

Physical science may be at a similar turning point to that of 1900, when observations of the speed of light in vacuum were beginning to upset the established paradigms of classical physics. This unsettling situation began to be resolved when Albert Einstein proposed the special theory of relativity in 1905.

Stellar consciousness, as defined here, is very simple. To partially explain the kinematical anomalies discussed in this book, a star must possess a simple herding instinct. Perhaps its consciousness is no more advanced than that of a slime mold amoeba.

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In 2011, I thought that it might be necessary to revive and resolve the debate on psychokinesis (PK) to explain how a conscious star might alter its trajectory. PK is the alleged ability of certain individuals to move objects at a distance by the power of will. But observations of unidirectional, high-velocity jets of material ejected from some young stars provide an alternative explanation. But since I have been privileged to know capable people on both sides of the PK debate, this subject is discussed in its possible relation to anomalous stellar motions.

As well as publishing the original conjecture in a scientific journal (*Journal of the British Interplanetary Society—JBIS*), I submitted it to an astronomical blog (*Centauri Dreams*). Many of the responses to the blog entry provided creative approaches to testing both stellar consciousness and PK. Happily (for me), a suggested alternative to stellar consciousness has not passed its first observational test.

The jury is still out and a verdict has not been returned. But a new European astronomical spacecraft, *Gaia*, has been launched and is now on station. Within a few years, intimate knowledge of the motions of about a billion stars in our galaxy may be available from this spacecraft. I await these results eagerly.

Foreword

As an astrophysicist, I appreciate the value of revolutionary ideas in science, but I also understand the unique challenges that confront efforts to advance them against the resistance of established scientific paradigms. It is important to point out that all established scientific paradigms are founded on the assumptions that were invoked by scientists to construct their hypotheses and theories. And it is the assumptions that are the most prone to replacement because new experimental evidence or improved theoretical developments come along which show the original assumptions to be wrong or incomplete. While my coworkers and I are exploring the overlap between the multi-layered structure of quantum vacuum zero-point fluctuations, quantum entanglement and teleportation, the sub-quantum information domain, and the physics of consciousness, the creators of this book are going far beyond this by investigating the possibility of stellar consciousness.

Stars might be conscious? That sounds patently absurd. But this is only absurd at face value given the long-cherished scientific *assumption* that only living beings are conscious and not nonliving matter, much less a massive astronomical-sized, hot, dense ball of plasma that is undergoing nuclear fusion. How can stars be conscious if they are not living beings? That is precisely the question that this book addresses, and the authors take the risk of seriously considering the evolving astronomical evidence for anomalous kinetic stellar motions in our galaxy that could turn out to be volitional. If real, then such stars might be using psychokinesis to project unidirectional jets of plasma in order to produce thrust. We do not yet have a physics theory of consciousness so the long-held paradigm that nonliving matter cannot possibly be conscious could be wrong.

The suggestion that stellar matter could be conscious is not really a stretch too far for science. Dmitri Krioukov and coworkers at the University of California-San Diego and the University of Barcelona suggest that the universe may be growing in the same way as a giant brain with the electrical firing between brain cells being “mirrored” by the shape and structure of galactic matter throughout the expanding universe (D. Krioukov et al., *NATURE Scientific Reports*, 2: 793, 2012). The results of their theoretical and computer model simulation suggests that natural growth dynamics—the way that systems evolve—are the same for different kinds of networks whether it is the social networks on the internet, the human brain, or the universe as a whole. The discovered equivalence between the growth of the universe and complex networks strongly suggests that unexpectedly similar laws govern the dynamics of these very different complex systems. The observed structural and dynamical similarities among different real networks suggest that some universal laws might be in action, although the nature and common origin of such laws remain elusive. A physics of consciousness could be the key to fully understanding this problem.

On the other hand, quantum mechanics predicts that anything that has the slightest chance of existing is virtually certain to exist, so that given enough time any vanishingly improbable event will occur. Taken to its logical conclusion, there is an extremely tiny probability of self-aware, disembodied consciousnesses, or “brains,” that spontaneously emerge from the quantum vacuum zero-point fluctuations of “empty” space everywhere across the universe (A. Albrecht and L. Sorbo, *Phys. Rev. D*, **70**: 063528, 2004; J. Garriga et al., *J. Cosmology and Astroparticle Phys.*, **0601**: 017, 2006; D. Page, *Phys. Rev. D*, **78**: 063536, 2008; A. De Simone et al., *Phys. Rev. D*, **82**: 063520, 2010). These are called “Boltzmann brains,” and over the entire history of the universe it is possible that such brains would outnumber consciousnesses such as ours. Boltzmann brains are named for the physicist Ludwig E. Boltzmann (1844–1906) who hypothesized that the universe is observed to be in a highly improbable non-equilibrium state because only when such states randomly occur can brains exist to be aware of the universe. So quantum mechanics, taken together with non-equilibrium thermodynamics and modern cosmology, appears to already provide a physics theory of consciousness. It could be possible that Boltzmann brains inhabit volitional stars and possibly even the entire universe itself, and it may even be possible that Boltzmann brains give consciousness to all sentient life forms.

Boltzmann brains could also be the source of a very unusual, but historically well-known and well-documented phenomenon called psychokinesis (PK). PK has been recorded in very ancient human history, but it is among the many types of human potentials that were explored during experimental research in the field of enhancing human performance for a military program called JEDI, which ran in the 1980s under the auspices of the U.S. Army Intelligence and Security Command and the Organizational Effectiveness School, and was sponsored by a U.S. government interagency task force (J. B. Alexander, R. Groller, and J. Morris, *The Warrior's Edge*, William Morrow & Co., New York, 1990; E. W. Davis, “Teleportation Physics Study,” *AFRL-PR-ED-TR-2003-0034*: 55–62, 2004). As strange as Boltzmann brains may sound to scientists and non-scientists alike, PK is an even stranger phenomenon. PK generally designates the movement of objects through other physical objects or over great distances. Telekinesis (TK) is a form of PK which describes the movement of stationary objects without the use of any known physical force. And PK/TK is essentially the direct influence of mind on matter without any known intermediate physical energy, physical contact, or instrumentation. Rigorously controlled scientific laboratory studies of PK/TK have been performed and/or documented by L. E. Rhine (1970), H. Schmidt (1974, 1987), H. E. Puthoff and R. Targ (1974, 1975), J. B. Hasted et al. (1975), R. Targ and H. E. Puthoff (1977), C. B. Nash (1978), S. Shigemi et al. (1978), J. B. Hasted (1979), G. B. “Jack” Houck (1984; <http://www.jackhouck.com/>), B. B. Wolman et al. (1986), W. Giroladini (1991), L. R. Gissurarson (1992), D. Radin (1997), C. T. Tart et al. (2002), R. Shoup (2002), and J. B. Alexander (2003) (the full references are listed in my U.S. Air Force report, “Teleportation Physics Study,” *AFRL-PR-ED-TR-2003-0034*: 63–72,

2004). My Air Force report also describes the laboratory PK research that was supported by the Soviet Union, the Warsaw Pact, and the People's Republic of China military and national science academy institutes. These studies demonstrated that PK/TK phenomenon cannot be conjured by magicians in staged magic show acts. If stars are truly conscious, then they might be using PK to project a single jet of plasma out into space in order to produce thrust to move beyond their confined Keplerian orbital motion in the galaxy.

My own theoretical research has led me to conclude that underlying the universe is a sub-quantum (SQ) information domain whereby the vacuum of spacetime is teeming with information as well as the ubiquitous complex multi-layered quantum vacuum zero-point fluctuations. And SQ information is what determines what manifests physically. SQ information might be Fisher Information (B. R. Frieden, *Physics from Fisher Information: A Unification*, Cambridge Univ. Press, Cambridge, U.K., 1999; *Science from Fisher Information: A Unification*, 2nd ed., Cambridge Univ. Press, Cambridge, U.K., 2004) or it might be quantum holographic universe information (J. D. Bekenstein, *Sci. Am.*, **289**: 58–65, August 2003). The jury is still out on which model best describes physical reality and the universe. But Fisher Information is the only theoretical framework so far that provides an approach to understanding consciousness. Like quantum entanglement, SQ information is nonlocal such that information and images can be robustly teleported via instantaneous quantum connections across spacetime. Nonlocal entanglement is common in nature and is not just a low-temperature or microscopic laboratory phenomenon—the quantum domain is not limited to microscopic size and mass scales or to brief instances of time. Several years of recent experimental research has demonstrated that quantum entanglement and teleportation, along with other quantum effects, have been observed in a growing number of large macroscopic systems as well as ones contained in high-temperature and high-pressure environments, including in living organisms (V. Vedral, *Sci. Am.*, **304**: 38–43, June 2011). Furthermore, astronomers have observed and catalogued macroscopic quantum matter of astronomical size, temperature, pressure, and mass such as neutron stars, quark stars, and white dwarf stars which are composed of Fermi-degenerate gases of nucleons or quarks and electrons. The combined experimental and theoretical research concludes that quantum entanglement gives spacetime its structure because causal order is not a fundamental property of nature.

My own research is concerned with the question of how might biological systems exploit SQ information and whether it is integral to consciousness. I also want to know what sort of information structures might exist in SQ information space. Could they be qualia (thought forms), Boltzmann brains, or the complex multi-layered quantum vacuum zero-point fluctuations? It turns out that quantum vacuum zero-point fluctuations are correlated (i.e., quantum entangled). Therefore, the SQ information space might be an SQ entanglement field, and its information structures might be the quantum vacuum fluctuations which can produce Boltzmann brains as previously discussed. Spatiotemporal SQ information structures should be required to interact with matter because

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matter is spatiotemporal. The synchronizing of spatiotemporal joint probability distributions in matter could cause many anomalies that involve no transfer of energy such as what is observed in, for example, synchronicities in nature, PK, remote perception, thought projection, and telepathy.

Thomas Kuhn wrote, “Discovery commences with the awareness of anomaly, that is, with the recognition that nature has somehow violated the pre-induced expectations that govern normal science” (T. S. Kuhn, *The Structure of Scientific Revolutions*, 2nd ed., Univ. of Chicago Press, Chicago, 1970, pp. 52–53). He described scientific discovery as a complex process in which an observed anomalous fact of nature is accepted and then followed by a change in scientific paradigm that makes the new fact no longer an anomaly. Science is a conservative activity. Such conservatism has the short-term asset of allowing each current paradigm to be articulated so clearly that it can serve as an organizing principle for the multitude of effects that scientists observe, but it can sometimes prevent the adequate recognition of observations that do not fit within the current theory. In addition, scientists may be reluctant to accept new theories, or recognize anomalies in the old theories, for the purely psychological reasons that the familiar is often more comfortable than the unfamiliar, and that inconsistencies in belief are uncomfortable—which is called cognitive dissonance. If unexplained facts can be glossed over or reduced in importance or simply accepted as givens, the possible inadequacy of the current theory does not have to be confronted. Then, when a new theory gives a compelling explanation of the previously unexplained facts, it is safe to recognize them for what they are. Such “retrorecognition” phenomenon of certain scientific anomalies has happened again and again throughout the history of science (A. Lightman and O. Gingerich, *Science*, **255**: 690–695, 1991). Stellar consciousness and PK most certainly fall into the category of retrorecognition phenomenon.

In this book, Greg Matloff and C Bangs present preliminary evidence for a new anomaly in astronomy that potentially could become the next retrorecognition phenomenon that upends a few established scientific paradigms. To build their case for stellar consciousness and explore what consciousness is, they take the reader through a grand tour of these concepts that includes the interweaving viewpoints of the shaman, the mystic, the astrologer, the philosopher, the poet, the novelist, the psychic, the neuroscientist, the molecular biologist, the physicist, the mathematician, and the astronomer. This tapestry of exploration is woven together by the rich artwork by C Bangs who expresses through her art the ideas and thoughts that are inexpressible by words. It is hoped that this book will inspire students and professionals, as well as the interested layperson, to explore this unusual new stellar phenomenon and initiate their own studies into consciousness, spacetime, cosmology, and their interrelationships.

Eric W. Davis, Ph.D., FBIS, AFAIAA
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August 2015

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We are especially grateful to the British Interplanetary Society for having us present early versions of the work described here on two separate occasions and for including a peer-reviewed paper by author Greg Matloff in an issue of *Journal of the British Interplanetary Society (JBIS)*. Also, thanks to Paul Gilster for including a longer version of Greg's paper in his *Centauri Dreams* blog and to the many people who commented on the blog entry. We also appreciate our publication on this topic in the *Baen Press* online science magazine.

Our presentations on stellar consciousness combining art and science at a meeting of the LASER art/science salon in New York City and at the Liberty Con and Dragon Con science fiction conventions were fun as well, thanks to the hard work of the organizers.

Much of the original art by C Bangs that has been integrated into the chapter frontispieces is on display at CENTRAL BOOKING art space, at 21 Ludlow Street in Manhattan. C appreciates the encouragement of gallery director and curator Maddy Rosenberg.

The library staff of New York City College of Technology, in Brooklyn, NY is thanked for securing an inter-library loan of Erich Jantsch's book, *The Self-Organizing Universe*. We also thank the research library staff of the National Museum of the American Indian in New York City for their assistance in locating books on Native American science and archeoastronomy.

Finally, we thank publisher Neil Shuttlewood, founder of Curtis Press, for his encouragement and assistance and the staff of that organization for producing the final product.

March 2015

Greg Matloff and C Bangs

About the author and artist

Greg Matloff is a leading expert in possibilities for interstellar propulsion, especially near-Sun solar sail trajectories that might ultimately enable interstellar travel. He is also a professor with the Physics Department of New York City College of Technology, CUNY, a consultant with NASA Marshall Space Flight Center, a Hayden Associate of the American Museum of Natural History, and a Member of the International Academy of Astronautics. He co-authored with Les Johnson of NASA and C Bangs *Paradise Regained* (2009), *Living Off the Land in Space* (2007), and has authored *Deep-Space Probes* (Edition 1: 2000 and Edition 2: 2005). As well as authoring *More Telescope Power* (2002), *Telescope Power* (1993), *The Urban Astronomer* (1991), he co-authored with Eugene Mallove *The Starflight Handbook* (1989). His papers on interstellar travel, the search for extraterrestrial artifacts, and methods of protecting Earth from asteroid impacts have been published in *Journal of the British Interplanetary Society*, *Acta Astronautica*, *Spaceflight*, *Space Technology*, *Journal of Astronautical Sciences*, and *Mercury*. His popular articles have appeared in many publications, including *Analog* and *IEEE Spectrum*. In 1998, he won a \$5000 prize in the international essay contest on ETI sponsored by the National Institute for Discovery Science. He served on a November 2007 panel organized by Seed magazine to brief Congressional staff on the possibilities of a sustainable, meaningful space program.



Greg Matloff is a Fellow of the British Interplanetary Society, has chaired many technical sessions, and is listed in numerous volumes of *Who's Who*. In 2008 he was honored as Scholar on Campus at New York City College of Technology. His most recent book, co-authored with Italian researcher Giovanni Vulpetti and Les Johnson, is *Solar Sails: A Novel Approach to Interplanetary Travel*, Springer (2008, 2015). In addition to his interstellar travel research, he has contributed to SETI (the Search for Extraterrestrial Intelligence), modeling studies of human effects on Earth's atmosphere, interplanetary exploration concept analysis, alternative energy, in-space navigation, and the search for extrasolar planets. His website is www.gregmatloff.com

C Bangs' art investigates frontier science combined with symbolist figuration from an ecological feminist point of view. Her work is included in public and



private collections as well as in books and journals. Public collections include the Library of Congress, NASA's Marshall Spaceflight Center, British Interplanetary Society, New York City College of Technology, Pratt Institute, Cornell University, and Pace University. The "I Am the Cosmos" exhibition at the New Jersey State Museum in Trenton included her work, *Raw Materials from Space* and the *Orbital Steam Locomotive*. Her art has been included in eight books, two peer-reviewed journal articles, several magazine articles, and art catalogs. Merging art and science, she worked for three summers as a NASA Faculty Fellow; under a NASA grant she investigated

holographic interstellar probe message plaques. Her recent book collaboration with Greg Matloff, *Biosphere Extension: Solar System Resources for the Earth* was recently collected by the Brooklyn Museum for their artist book collection. *Harvesting Space for a Greener Earth* published by Springer came out at the end of April 2014. She is represented at the New York City Gallery CENTRAL BOOKING Art Space.

Since 1995 she has included quantum equations and diagrams by quantum consciousness physicist Evan Harris Walker in her paintings, after making his acquaintance in 1991. They exchanged ideas on the reality or nonreality of space-time and on his innovative theories concerning the relationship between quantum mechanics and consciousness that lasted until his death in 2006. These equations function as design elements and refer to the interconnectivity of everything and the relationship of time to space. Her website is www.cbangs.com



INTRODUCTION

A lesson for the professor

Hot sun, cool fire, tempered with sweet air,
Black shade, fair nurse, shadow my white hair:
Shine, sun; burn, fire: Breathe, air, and ease me:
Black shade, fair nurse, shroud me, and please me:
Shadow, my sweet nurse. Keep me from burning”

George Peele, *Bethsabe Bathing*

Sometimes, college professors can learn a great deal from their students. Such was the case for me a few years ago. What I then learned from a student is one of the roots of this book.

As part of my responsibilities as a tenured professor in the Physics Department of New York City College of Technology (which is located in downtown Brooklyn and is part of the City University of New York), I had developed an astronomy program. Tailored to fit the requirements of liberal arts majors, this freshman/sophomore level course is organized in two consecutive semesters. As is customary in such courses, the first semester is devoted to astronomical history, physical science theory, and details of our Solar System. The second semester includes consideration of the stars, galaxies, cosmology, extrasolar planets, life in the Universe, and other topics in astrophysics.

A DARK DISCUSSION

In an Astronomy 2 lecture late in the semester, I was presenting the current state of the hunt for dark matter. This hypothetical substance, which theoretically accounts for about three quarters of the mass in the Universe, has been invoked to explain strange aspects of the motions of distant stars and galaxies. But it has proven to be extremely elusive. Moreover, attempts to modify gravity theory to accommodate this phenomenon have not succeeded.

A student raised his hand. Since I encourage class participation, I recognized him. “Let’s see,” he exclaimed. “The stars are observed to move around the galaxy’s center as if they are attached to the spokes of a wheel, with those farther from the center moving faster.” I agreed and suggested that he continue.

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“So it is assumed to explain this phenomenon that an invisible cloud of matter surrounds the visible component of the universe. The particles that make up this cloud have not been detected although their combined mass greatly exceeds that of the Universe’s visible mass. But all attempts to locate this material has failed and spacecraft trajectories seem unaffected by its presence in the Solar System.” Once again, I confirmed that he was correct.

“Furthermore, attempts to modify Newton’s and Einstein’s gravity equations to account for this effect have failed.” I told him that he was on a roll.

The class waited expectantly for his conclusion, as did I. “I think that we have to make an attempt to save the system, kind of like what went on around 1900 when the anomalies that led to relativity theory were recognized. Perhaps the whole attempt to postulate and search for new particles that solve the dark matter problem will fail. Instead, physics may eventually have to alter its organizing paradigm as happened back then.”

Two angels rested on my shoulders as he presented his case for dismissing the dark matter hypothesis with radical surgery. My dark angel suggested that I shut this student up. He was deviating from the lesson plan and taking up valuable class time. After all, we had only a few more lessons to complete the syllabus.

But my bright angel offered contradictory advice. A major purpose of science courses for liberal arts majors is to encourage critical and independent thought in students, to reduce their sensitivity to commercial and political pressures. He was certainly displaying these traits. Not only was his mind racing beyond the confines of the lesson and textbook, but he was challenging the mainstream thought processes and assumptions of astrophysics.

This student did very well in the course. What is more, his objections to conventional thinking regarding dark matter have always stayed with me.

THE PHYSICS OF CONSCIOUSNESS

A second root for the ideas that developed into this book is a chance occurrence much earlier in my professional career. As a graduate student in the early 1970s, I collaborated with a friend, the late Al Fennelly, who was then studying for his Ph.D. from Yeshiva University in New York City.

Al and I were very excited by the concept we had developed for a spacecraft that could reach high velocities and reach the near stars within a human life-time using cosmic energy fields. We were so happy with the idea that we posted the manuscript to *Science*, one of the most prestigious international peer-reviewed journals.

Following its traditional approach, the journal sent our manuscript to two selected anonymous reviewers. We were saddened to learn from one of these prestigious people that we had neglected some very fundamental physics and merely invented a nonfunctional perpetual motion machine.

The second reviewer was kinder, however, although he also pointed out our error. He identified himself as Evan Harris Walker, who was working at the time at the now-defunct NASA Electronics Center in Boston. Although Harris (as his friends called him) was employed in plasma physics and thus was well suited to review our manuscript, we learned that one of his main interests was quantum physics and its philosophical implications.

Harris instructed us on how we could salvage a portion of our conceptual starship. Even if it could not accelerate to high velocity without fuel, the technique we suggested might have application to deceleration. Following Harris's advice, we revised the manuscript and submitted it successfully to the *Journal of the British Interplanetary Society (JBIS)*, which was beginning a formal study of interstellar concepts. Our 1974 paper eventually evolved into the magsail, a proposed means to decelerate a starship by magnetically reflecting interstellar ions.

Al and I developed a nice professional friendship with Harris, who soon moved from Boston to a position with a U.S. Army research facility in Aberdeen, Maryland. Although the three of us co-authored papers in *JBIS* on in-space propulsion and detecting the planets of other stars, Al and I became fascinated by one of Harris's quantum interests. He had become affiliated with a group of physicists and psychologists who were applying quantum physics to investigate the basis of consciousness and were mostly based at west-coast institutions including Stanford Research Institute (SRI) and Berkeley.

Harris's approach to quantum consciousness was not hard to understand. In his papers and books he discussed the fine structure of neurons—those cells that comprise our brains. Synapses are the structures within neurons that transmit signals from one neuron to another. Synapses are electrically conductive and typically separated by 20 billionths of a meter or 20 nanometers (20 nm). Such a tiny separation between electrical conductors allows for the possibility of various quantum events.

In Harris's theory, wave functions associated with subatomic particles bounce around within the electrical potential wells of the intersynaptic spacing. If you try bouncing a tennis ball against a wall, after a trillion bounces you might conclude that the wall is completely opaque to the ball. But at the quantum level, there is a finite probability that the wave function will instantaneously tunnel through the potential well and materialize somewhere else. This is a very well-established quantum event. Tunneling diodes, in fact, have become standard electronic components.

Initially, Harris and his colleagues were interested in how a thought might move from one part of the brain to another by exploiting quantum tunneling. But some readers realized that a thought could theoretically be transferred not merely from one brain location to another but between brains.

In the depths of the Cold War, this possibility attracted the attention of certain well-funded intelligence-gathering agencies. Imagine that you are a spy. You can certainly lead the glamorous (and likely) short life of James Bond. But how much more comfortable and safer it would be to arrive at your office,