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David Kaiser
How the Hippies Saved Physics: Science, Counterculture, and the Quantum Revival
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The book traces the hidden history of quantum theory from the 1930s to the 1970s – the years of World War II, the Cold War and the counterculture revolution – with some references to the present day. Divided into 10 chapters, it deals with one of the most intriguing fields of theoretical physics, which, according to Kaiser, benefited from the contributions of borderline scientists, as we may call them, who had a penchant for New Age philosophy. As the book shows, physics actually thrived on and fostered the 1970s counterculture in American college campuses, in a mishmash of LSD trips, Eastern mysticism, spoon-bending psychics, charismatic activists and freewheeling researchers looking for new challenging routes.

In his rich, witty and humorous narrative, Kaiser identifies the connections and alliances between the founding fathers of modern physics – namely, Einstein, Bohr, Heisenberg and Schrödinger – and the quantum physicists in the Bay Area (such as Elizabeth Rauscher, George Weissmann, John Francis Clause, Jack Sarfatti, Saul-Paul Sirag, Fred Alan Wolf and Herry Stapp, among others). In the years between 1975 and 1979 (when the group split up), these researchers looked for a new approach to physics, defying the "shut up and calculate" attitude that had dominated it since the post-war period. Thanks to their work, in the mid-1970s, quantum physics took on new philosophical challenges, establishing fruitful connections with the theories of perception and New Age culture, and contributing to a new understanding of the universe (much of the spirit of the time is captured in Fritjof Capra's famous book *The Tao of Physics*: An Exploration of the Parallels Between Modern Physics and Eastern Mysticism, published in 1975).

Kaiser argues that quantum information science, which is today used to securely transfer money and electronic votes, was born in a cultural context that was totally foreign to traditional academic or business schools, being rooted instead in the 1970s counterculture. It was in this context that an unconventional bunch of scientists went back to some of the theoretical issues posed in the 1920s – issues that some physicists had continued to explore during the Fascism, the Cold War and the Vietnam War.

David Kaiser reconstructs the hidden history of the Fundamental Fysiks Group in Berkeley, and its wide range of followers, by collecting a vast number of interviews with the protagonists of those years. He meticulously and humorously chronicles the lives of these non-conformist dreamers, who questioned the boundaries between science and consciousness and laid the foundations for a new theoretical physics, whose most recent application, still in development, is quantum cryptography.

In 2012, the book was selected as the "Book of the Year" by the prestigious *Physics World* magazine, which found the book "well written, scientifically interesting and novel" and described it as "a rollicking good read".

The book is about network builders, groups, fluid alliances, convergences, opportunities that become projects, promoters, financial backers, journals, group conflicts and personal rivalries, controversies, search for experimental evidence. It tells the story of a handful of emerging physicists who dared to look into the borderline where physics and other disciplines meet, trying to solve age-old but still unanswered questions.

Kaiser tells this long story in an STS perspective, without making explicit references or turning it into an academic exercise, so that even non-expert readers may approach the subject and enjoy the reading, while a more experienced eye will notice and appreciate the hidden threads that weave the book to Latour's Science in Action, Kuhn's paradigm shifts and James Watson's personal account of the discovery of the double-helix structure of DNA.

In the first chapter, Kaiser introduces the cultural climate in which the group was operating. At the end of the 1960s, the Vietnam War, the global economic downturn, energy crisis and "stagflation" led to massive cutbacks on spending for basic research, especially for physics. In 1967 military planners revoked draft deferments for undergraduates and, soon afterwards, for graduate students as well. As a consequence, at the beginning of the 1970s, student enrolments plummeted dramatically. Any interest in quantum mechanics and its philosophical implications had vanished after the Second World War. In the Cold War period, student enrolments in physics started increasing again, but the "shut up and calculate" branch of physics prevailed, turning physics from a broad-thinking science, open to discussions and interpretations, into a hyper-pragmatic enterprise. At the beginning of the 1970s, with the worsening of the economic crisis, the students joining the army for the Vietnam war and the rise of student movements, a ragtag crew of young physicists banded together and founded an informal discussion group "in a fit of pique and frustration", as Kaiser puts it. They reserved a seminar room at Berkeley and met on Friday afternoons at 4 P.M. The founders were Elizabeth Rauscher, the only woman in the group, and George Weissmann, at the time both graduate students at the University of California, Berkeley. They started with informal brainstorming sessions, which in a few years became increasingly popular, and called themselves Fundamental Fysiks

Group. As Kaiser argues, the group was questioning Popper's demarcation theory and its sharp distinction between science and non-science. The physicists who gravitated toward the group in those years had a penchant for psychedelics and quantum physics, and trespassed the line of demarcation between the two.

Chapters 2 and 3 are dedicated to the development of the group and its research themes. Making the most of their New Age entrepreneurial spirit, they managed to secure financial backing and concentrated their interests, experimental practice, publications and conferences on the work of Irish physicist John Bell, who in the mid-1960s conducted a series of theoretical studies that had little to do with the "shut up and calculate" approach. The relevance and theoretical significance of Bell's work would be too long and complicated (and impossible for me) to explain here. Suffice it to say that his work, which became the source and the driving force behind the theoretical studies of the Berkeley's group, was deep-rooted in electromagnetism, and called into question some aspects of Einstein's theory. Bell's tests intended to demonstrate the non-local nature of quantum mechanics; the hypothesis he investigated at an experimental level was that there are hidden variables that do not operate in a deterministic way. Particles, according to Bell, are correlated by non-local and non-deterministic hidden entanglements. Non-locality and entanglement were a major source of inspiration for the members of the Fundamental Fysiks Group, who in those years produced a vast number of publications on this subject. Their approach to science was a sort of "collage" combining experimental tests (as in the case of Clauser, who tried to disprove Bell's theorem and ended up confirming it) and theoretical reflections verging on metaphysics and consciousness expansion (such as those by Elizabeth Rauscher).

As Kaiser explains in Chapter 4, Bell's study of non-locality and quantum entanglement provided a common ground where scientists and hippies could join together. The road map of quantum physics ended up leading to New Age philosophy. Measurements gave way to speculations and paranormal experiments. In the same years, the Group established a significant relationship with the Stanford Research Institute (SRI), where a number of conferences were held on themes related to parapsychology and consciousness expansion. Although these physicists often ventured into psychedelic realms, they never pushed their ideas too far, basically recognizing – as Nobel laureate Wigner argued – that it was not possible to formulate the laws of quantum mechanics in a fully consistent way without reference to the consciousness of the observer.

Chapters 5, 6 and 7 examine the dissemination of their research findings through journals, conferences and seminars. In 1976 the first workshop on physics and consciousness was held at the Esalen Institute in Big Sur, California. The Institute became the place where different interests, groups, workshops and forums converged, integrating the development of human potential with Eastern religions and quantum physics. In this

place, researchers experimented with new ways of approaching science and consciousness. There were no chairs, only cushions, hot tubs, incenses, candles and LSD.

One of the foremost exponents of the counterculture operating in this context was Ira Einhorn, an environmentalist advocate and a friend of Kuhn, who promoted and sponsored a number of events, such as the Earth Day, bringing together quantum physics, ecology and pacifism, and was eventually convicted for the murder of his girlfriend.

The Tao of Physics by Capra was published in the same years, bridging the gap between science and consciousness, and becoming a true best seller as well as the ideological manifesto of a whole generation.

In the last three chapters, Kaiser wonders whether and to what extent the Fundamental Fysiks Group can be considered as a marginal phenomenon in the history of physics. In spite of their marginal position, they actually left a memorable mark, as they were actually able to connect psychedelic realms and mainstream science (Chap. 8). The author examines the impact of the group on the developments of a scientific research field that has today evolved into quantum cryptography (Chap. 9), and goes through their publications (such as Nick Herbert's work on the flash system) to retrace their critical reception and consider the most recent applications of their ideas of quantum and consciousness. In Chapter 10, he describes the end of the Fundamental Fysiks Group in 1979, their legacy and contributions to a series of cultural transformations that started in Berkeley and the San Francisco Bay Area and continue today in Silicon Valley, with biotechnologies and Apple.

In Kaiser's opinion, the cultural role of the group is related to its ability to foster a new approach to science, broaden physicists' research perspectives and expand our collective imagination. The Fundamental Fysiks Group may not have saved physics but has certainly renewed its visions and practices. Through the Fundamental Fysiks Group, the "Fringe" of physic research (to quote the title of a well-known TV series) established a fruitful connection between the most radical worlds of psychedelic New Age and institutional physics. The work of these intrinsically post-modern physicists has produced consequences in distant realities, which sound as a confirmation of the hidden entanglement and non-locality of Bell's theorem. While experiencing that fantastic moment of convergence between the 1970s Californian New Age and the attempts to go beyond Einstein's theory of relativity, those hippy physicists could not imagine that, 40 years later, their "entanglement" would arrive so far. As we said, this sounds as a confirmation of Bell's theory, which was actually verified in 2012 by a team of researchers led by Anton Zeilinger at the University of Vienna, who successfully performed a quantum teleportation experiment.

In his account, Kaiser follows the "anomalies" of science, as Kuhn would put it, and the new and multiple paradigms they produce through practice. Today, electronic money transactions can actually be carried out by using entangled photons to create an unbreakable communications

code, and quantum cryptography is used by banks and financial institutions. Hippies may not have saved physics, but have certainly contributed to projecting it forward, paving the way for quantum-encrypted bank transfers, transmissions of entangled photons, and much more. In the final acknowledgments of the book, Kaiser states that writing this book was an amazing adventure for him. We bet it was.