An Appreciation of Norman D. Cook

By David J. Nagel

Norman D. Cook started coming to the ICCF conferences relatively recently. He gave the following talks at the indicated conferences:

1. N. Cook, "Toward an Explanation of Transmutation Products on Palladium Cathodes," ICCF-14 (2008)

2. N. Cook and V. Dallacasa, "Simulation of Palladium Transmutation Products," ICCF-15 (2009)

3. N. Cook and V. Dallacasa, "The FCC Substructure of the Nucleus and the Magnetic Interaction among Nucleons," ICCF-15 (2009)

4. N. Cook and P. Di Sia, "The 'Renaissance' in Nuclear Physics: Low-Energy Nuclear Reactions and Transmutations," ICCF-21 (2018).

Photo by A.J. Frankson

This photo of Cook was taken at that conference. A video of his presentation is available[1]. The dozens of graphics from that presentation show the breadth and depth of the author's treatment of the topic[2]. A published summary[3] of the ICCF-21 talk by Cook is reprinted in the following paragraph.

Norman Cook of Kansai University and Paolo Di Sia of Padova University gave a paper with the title "The 'Renaissance' in Nuclear Physics: Low-Energy Nuclear Reactions and Transmutations." Their presentation started with the case for the acceptability of lattice models of the nucleus in opposition to the historical view of their impossibility. Specifically, they stated "Nuclear Lattice Effective Field Theory (NLEFT) has been developed by Ulf Meissner *et al*. in which conclusions at a new level of spatial detail concerning nuclear structure have become possible. Because NLEFT entails specification of individual nucleon positions within a lattice of nucleons, it explicitly contradicts the dominant 'Copenhagen' interpretation of quantum mechanics." The authors then noted the two main competing lattice nuclear models, the Simple Cubic and Face-Centered Cubic (FCC) versions. They then made the case for the FCC model, which is treated in detail in Cook's book on Nuclear Physics[4]. A strong point was made that all the symmetries of the Independent Particle (Shell) Model of the nucleus are present in the FCC lattice model. The talk included numerous graphics on lattice simulations of LENR-related topics. Such computations can be done using a Nuclear Visualization Software QND tool written by Cook, which is available on the internet[5]. It is part of his postings on Quantum NucleoDynamics (QND)[6].

Cook was a clearly an accomplished specialist in nuclear structure. Since the reactions of nuclei are structure-dependent, it made sense that he would be interested in the topic of Low Energy Nuclear Reactions (LENR). It appeared that he hoped that his view of nuclear structure would contribute to the understanding of LENR, as it had to the prediction of fission fragment distributions from Actinides. Maybe even, the ultimate understanding of LENR would illuminate some of the many questions about the structure of nuclei.

Nuclei were discovered in 1911 by Ernest Rutherford[7]. That landmark in the understanding of atoms was based on data from the 1909 Geiger-Marsden experiment in which they scattered alpha particles (helium nuclei) from thin gold foils[8]. Despite over a century of experimental and theoretical work on nuclei, the understanding of nuclei is in a very odd situation. There are multiple models, each of which is useful in understanding the results of some experiments. However, they have not been fully rationalized with each other. One of Cook's books is entitled *Models of the Atomic Nucleus*. It contains material on Collective, Cluster, Independent Particle and other nuclear models. Three of the major conventional nuclear models are discussed in detail on Cook's website[9]. The Shell Model of the nucleus, similar to standard atomic shell models, is the best known of the Independent Particle Models. The FCC Lattice Model, well developed by Cook, is one of the "other" models. The Preface of the book contains this statement: "The symmetries of the FCC lattice are identical to those of the independent particle model and the independent particle model is orthodox nuclear theory." In other words, Cook was promoting some unification of nuclear models, beyond making the case for the efficacy of the FCC Lattice Model of the nucleus.

Cook had just finished the Third Edition of *Models of the Atomic Nucleus* at the time of his death. It will be distributed by *Infinite Energy* and the New Energy Foundation. A fund to finish the printing process will be announced. In addition to the contributions to the ICCF-X conferences noted above, Cook also published other papers on LENR in recent years.

1. N. Cook and V. Dallacasa, "LENR and Nuclear Structure Theory," *J. Condensed Matter Nuclear Science*, Vol. **13**, pp. 68-79 (2014)

2. Norman D. Cook and Andrea Rossi, "On the Nuclear Mechanisms Underlying the Heat Production by the E-Cat," https://arxiv.org/abs/1504.01261 (2015)

3. N. Cook, "LENR Theory Requires a Proper Understanding of Nuclear Structure," *J. Condensed Matter Nuclear Science*, Vol. **24**: pp. 60-74 (2017)

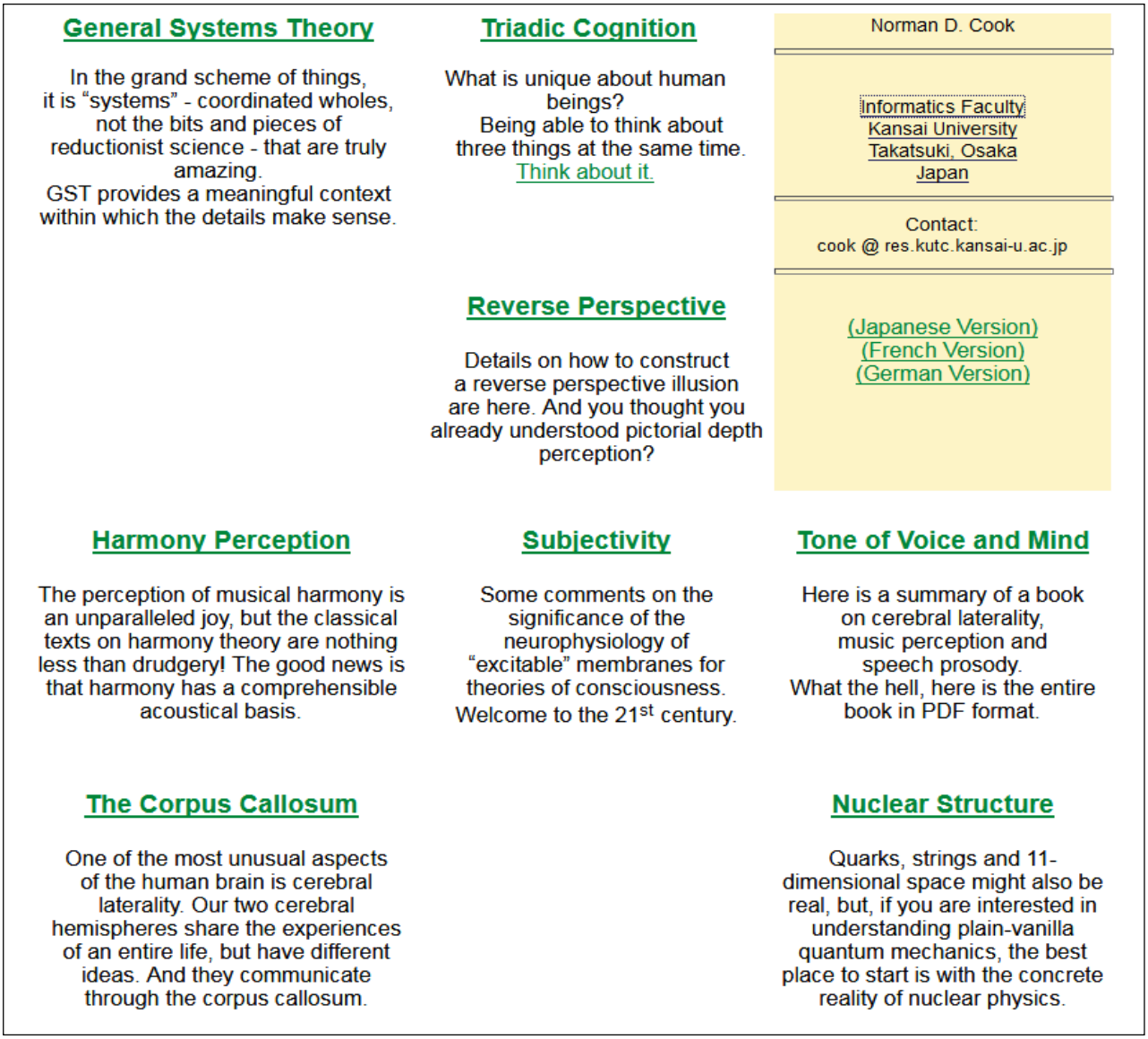
Besides being a productive scientist, Cook was a gracious gentleman. His ability to interact effectively with diverse people was demonstrated again at ICCF-21. At that conference, a group devoted to the study of nuclear structure was nucleated due to the leadership of Norman Cook and Bob Cook. The two Cooks are not related biologically, but they share a strong interest in the interactions between the sciences of nuclear structure physics and LENR. Their evening meeting during ICCF-21 attracted about 20 participants. The photo shows Norman Cook during that active and interesting discussion. The core group of nuclear theorists continues to communicate on various topics, especially the reconciliation of the various nuclear structure models. Those ideas include the Lattice, Structured Atom, Alpha Particle, Quantum Spring, Cluster and Deep

Orbit nuclear models. The group later compiled a list of Purposes and Principles for their on-going discussions. The self-assembly and emergence of that Nuclear Structure Group was one demonstrable benefit of ICCF-21.

Cook was the target of many of my emails on nuclear theory and related topics. He responded quickly and usefully. One exchange led to Cook telling me about problems he had within the nuclear physics community with a cantankerous journal editor. It had nothing to do with LENR, but was another instance of suppression of opposing views, in that case, Cook's FCC Model of the Nucleus. The journalistic mistreatment suffered by LENR over the decades is not uncommon in scientific communications.

Norman Cook's work on Nuclear Structure can be viewed in a much larger context. The understanding of LENR might contribute to the trend toward conceptual unification of the basic levels of matter. Currently, there is increasing interaction between High Energy Physics and Nuclear Physics, as forces *within* nucleons are being related to forces *between* nucleons. In a somewhat similar fashion, understanding of LENR could lead to a closer intellectual relationship between the nuclear and atomic levels of matter. It is appropriate that Nuclear Physics, with its multiple models, is in the middle of the current attempts to understand LENR. The new subject raises old and unresolved issues in Nuclear Physics. Could understanding of LENR lead to a more integrated and mature Theory of the Nucleus?

This appreciation might have ended here, if I had not looked into Cook's background. It was known that he worked at Kansai University in Japan. However, I had no idea of the breadth and depth of his intellectual endeavors. He was part of the Faculty of Informatics. The website of that faculty listed General Systems Theory as Cook's main topic and Cerebral Laterality and Triadic Cognition as his research themes. The last figure is from a Kansai University website. It gives an overview of the topics that Cook studied[10]. The blank spaces in that figure were images that do not reproduce well. Cook's comments on that website reflect his sense of humor, one of the many nice features of his character.



Cook's profile on Google Scholar was also surprising[11]. It notes the following topics: Nuclear Physics, Consciousness, Corpus Callosum, Harmony and Triadic Cognition. The Corpus Callosum is the neuronal superhighway between the two halves of the human brain. Triadic Cognition is the human ability to have three simultaneous processes in mind at the same time. That Google Scholar profile also lists his papers and their number of citations. A rough count of his papers is about 200. One of his 2018 papers "The Brain Code: Mechanisms of Information Transfer and the Role of the Corpus Callosum" has already been cited over 250 times. Overall, his papers have garnered more than two thousand citations from 1986 to the present. Some of the papers were in Japanese. And, some were published in journals well outside of nuclear physics, such as the *Journal of Music Perception and Cognition*. Searching Amazon Books with "Norman D. Cook" turns up some interesting titles. They include: *Tone of Voice and Mind: The Connections between Intonation, Emotion, Cognition and Consciousness*; *Harmony, Perspective, and Triadic Cognition*; *The Brain Code: Mechanisms of Information Transfer and the Role of the Corpus Callosum*; *Stability and Flexibility: An Analysis of Natural Systems* and *Machine Translation: How Far Can it Go?* These topics make it clear that a number of diverse scientific communities, in and beyond nuclear physics, have lost a remarkable polymath.

Acknowledgement: Steve Katinsky is thanked for the ICCF-21 photo of Norman Cook.

[1] https://www.youtube.com/watch?v=yYzrBtU_Bis&feature=youtu.be
[2] https://www.dropbox.com/s/an7egzip3s6f5el/Cook%20N%206-4.pdf?dl=0
[3] D. J. Nagel and S. B. Katinsky, "Overview of the 21st International Conference on Condensed Matter Nuclear Science", Infinite Energy, Issue 141, pp. 11-40 (2018)
[4] Norman D. Cook, "Models of the Atomic Nucleus", Springer Verlag, Berlin, Second Edition (2010)
[5] Norman D. Cook, Nuclear Visualization Software QND, http://www.res.kutc.kansai-u.ac.jp/~cook/40%20NVSDownload.html
[6] Norman D. Cook, Quantum NucleoDynamics, http://www.res.kutc.kansai-u.ac.jp/~cook/09%20NVSIndex.html
[7] https://en.wikipedia.org/wiki/Atomic_nucleus
[8] https://en.wikipedia.org/wiki/Geiger%E2%80%93Marsden_experiment#The_1909_experiment
[9] http://www.res.kutc.kansai-u.ac.jp/~cook/39%20NVSHistory.html
[10] http://www.res.kutc.kansai-u.ac.jp/%7Ecook/
[11] https://scholar.google.com/citations?hl=en&user=VJJTciMAAAAJ