Perhaps the most important discussion missing was regarding the different meditation techniques used in the published research. Zen, TM, and yoga (among others) were mentioned, but the authors made little attempt to describe the similarities or differences in these techniques. Granted, this is a book about meditation research, not meditation techniques, but nonetheless it would have been invaluable to include some general information to put the research descriptions in context. Also, the authors do not mention that the efficacy of meditation often may be dependent on the type of meditation being practiced or on the quality of instruction, rather than on the simple practice of meditation itself.

All in all, the book was extremely useful in showing the varied kinds of research in the field of meditation. The reviewer would certainly recommend this book for anyone who wants to know more about the kinds of research being done or who is looking for more information about a particular aspect of meditation research. The bibliography alone would be invaluable in this respect.

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The Grand Unified Theory of Classical Quantum Mechanics by Dr. Randell L. Mills. Blacklight Power Inc.: 41 Great Valley Parkway, Malvern, PA 19355, USA, September 1996, hardback, 557 pages, ISBN 0-9635171-2-0.

This book of 517 pages divided into 5 sections is an attempt to completely rewrite physics, the revision based largely on the conjectured existence of *fractional quantum states*. The first section of 14 chapters describes Mills' modified quantum mechanics (QM) of few-body systems. The second section entitled "Collective Phenomena" covers statistical mechanics, superconductivity, the Quantum Hall effect, and the Aharonov-Bohm effect. Section III covers GR and nuclear physics. A short Section IV is a more leisurely discussion of the modified QM. Section V presents supporting experimental evidence.

Ordinarily, given the impressive volume of physics covered herein, one would expect this to be the work of a knowledgeable and scientifically trustworthy author. At the outset however, the reader is confronted with an inconsistent deployment of symbols and nomenclature. The following example is typical. Eq. (I.20) is a wave-equation, presumably for a massless scalar particle:

$$\left[\nabla^2 - \frac{1}{v^2}\frac{\delta^2}{\delta t^2}\right]\Psi(r,\theta,\phi,t) = 0 \qquad (I.20)$$

Here the symbol v stands for the speed of light, and the symbol Ψ is termed a wave function, and reappears in (I.22) in lower case (unannounced) as $\psi(\mathrm{r},\theta,\varphi,t)$. (Strangely, here and throughout the book, δ rather than ∂ is used to denote partial differentiation.) Subsequently, in Eq. (I.29), normalization of the solutions to Eq. (I.20) is given as

$$\int_{-\infty}^{\infty} \Psi^2 dv = 1 \qquad (I.29)$$

This simple equation offers from 3 defects:

- Previously, Eq. (I.26) described a complex ψ, so the integrand in Eq. (I.29) should obviously be $\psi^* \psi$.
- Without warning, v in (I.29) has now (apparently) become a volume (V would normally be used here).
- The limits imply integration in one dimension, when apparently three are intended.

These kinds of "slips" are not fatal, but their effect is to create distrust of the author's grander claims on the bigger issues. Worse, some equations are unsalvageable. Eq. (I.3) for instance — apparently a major link in the central chain of reasoning — asserts that an electric field is proportional to the product of the current density and charge density. I have no idea what was really intended. Despite these difficulties, below I shall try to give a few of the major steps in Mills' revised physics.

His starting point is a reconsideration of the electron orbitals of the hydrogen atom. Historically, a correct description of these was the first major success of quantum theory. The classical physics (of the pre-quantum era) was unable to explain the stability of the hydrogen atom; it predicted that the electron would spiral into the nucleus, radiating away its energy as light over a continuous range of frequencies. Experimentally, however, it had been determined that the emission spectrum of hydrogen contained only discrete frequencies. In 1913, Niels Bohr suggested an *ad-hoc* model whereby the electron was allowed to orbit only at particular, fixed, radii. He suggested that the observed emission spectra resulted from transitions between these discretely separated radii. One of these radii must be a smallest possible radius, beyond which the orbit can shrink no further. Thus, the stability and emission spectrum of hydrogen were accommodated. In 1926, Ernst Schrodinger suggested a differential equation — which became the basis of modern quantum theory — to replace the classical equations. Applied to the hydrogen atom, Schrodinger's theory did indeed support Bohr's empirical model of the emission spectrum. But it did not agree with Bohr's model of the electron orbitals. Instead of occupying discrete radii, the allowed orbitals were members of a set of *distributions* (of radii), and the spectrum corresponded to transitions between *distributions*.

An understanding of the difference between Bohr's model and Schrodinger's theory is crucial for an appraisal of Mill's book. Bohr's model is not based on a dynamical set of equations for the motion of an electron. His model connotes a picture of the electron as a particle confined to one of a discrete set of (thin) shells centered on the nucleus. As a result of its singular nature, though this might still be termed a "charge distribution," it could not be predicted by a differential equation, since differential equations do not, in general, support such singular behavior. Instead, if they turned out to be accurate descriptions of electron orbits, these orbital shells would have to be taken as a "hard-wired" fact of nature, quite outside of the dynamics governing the transitions from one radius to another. Historically, the Schrodinger theory has been accepted as more correct, and the Bohr model is now used only when an approximate picture is sufficient.

Against this background, Mills' modified physics goes something like this:

1. Rather than require the wave-functions which are solutions of Eq. (I.20) to vanish at infinity (as they are in the Schrodinger theory), he asserts that instead (in spherical coordinates) one should use radial eigenfunctions going as

$$\psi_n \sim \frac{1}{r^2}\delta\left(r - r_n\right)$$

   where the r_n are allowed radii.
2. The r_n come from the condition that there is no radiation from the eigenstate.
3. These two conditions give both integer and fractional energy levels (*i.e.* $E_n \sim 1/n^2$; $n = 1,2,3...$ and $n = 1/2, 1/3, 1/4...$) for an electron in a Coulomb potential.
4. The resulting eigenstates have spatial distributions that are (delta-valued) spherical shells at allowed radii (as in item 1).
5. More generally: charged particles are always two-dimensional entities; the free electron is a spherical shell with a Compton radius.

Mills' theory of the electron is somewhere between that of Bohr and

Schrodinger. Like Bohr but unlike Schrodinger, the Mills electron is confined to a thin shell. Like Schrodinger but unlike Bohr, the Mills electron is distributed (throughout the shell). It follows that the foundation upon which Mills builds is his own, and not that of either Bohr or Schrodinger. His fundamental mistake is to assert that his orbitals are solutions of differential equations (in the manner of Schrodinger). In so doing, he confuses Bohr's provisional, pictorial model with Schrodinger's richer mathematical description. The problems are as follows:

- Mills' eigenfunctions are not normalizable.
- The Mills' model of the electron is not a solution of Eq. (I.20) (as he claims), nor of any (homogeneous) sensible wave equation.
- The proposed radial "eigenfunctions" vanish at infinity, and therefore cannot be motivated by the boundary condition changes Mills proposes (item 1 above).
- His claim that the integer values for n give predictions that are consistent with quantum mechanics is also incorrect. This follows from the discussion above concerning the difference between Schrodinger distributions and Bohr orbitals. The quantum mechanical (Schrodinger) radial eigenstates are not the thin shells given by delta-functions, but are distributions along the radius.
- There is no evidence of a structure for the free electron; a spherical shell with a Compton radius would have been noticed long ago.

As a result of these shortcomings, this book is flawed at an early stage. Since so much of the remainder of Mills' physics is built upon this foundation, sadly, the whole enterprise founders. More generally, the book appears to be a collage of text and equations with a short coherence length frequently interrupted by an assertion or equation that appears to be unrelated to what has gone before. The likely result is a confused and alienated reader.

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The Mars Effect: A French Test of Over 1,000 Sports Champions by Claude Benski, Dominique Caudron, Yves Galifret, Jean-Paul Krivine, Jean-Claude Pecker, Michael Rouze, Evry Schatztman, with a commentary by J.W. Nienhuys. Amherst: Prometheus Books, 1996, 137 pp. (no price indicated) (p). ISBN 0-87975-988-7.

The Tenacious Mars Effect by Suitbert Ertel and Kenneth Irving. London: Urania Trust, 1996, 201 pp., 9.95 British pounds (c). ISBN 1-971-989-15-9.