Applications of the Wave Structure of Matter

Knowing the true structure of matter allows calculation of many applications of material sciences that were poorly known before. Most applications involve understanding the behavior of matter at very *small dimensions* where the particulate approximation fails and the WSM is necessary to understand what is happening when different substances interact chemically, electrically, or biologically. Some occur in the computer field such as the development of semiconductor devices. Biological interactions, digestion, nutrition, and medicine, are very important in human health and can now be studied on a calculated basis. Chemical interactions are involved in the development of energy storage devices such as batteries, and in metallic alloys where the common R&D practice is trial and error. The WSM may improve this practice because knowing the true atomic wave structure often allows prediction of useful properties or to develop materials having a specified need. Using the WSM it is now possible to calculate and understand the binding between different atoms and molecules, due to resonant joining of wave structures between them. Formerly, this could not be done using discrete particles because their wave do not exist in a particle model. Some applications are discussed below:

Recent work on the Wave Structure of Matter

Mathematical Research of the Wave Structure of Matter. After the advances of W&F, Schrödinger and Einstein, little research was done on the structure of particles; After 1945, particle physicists chose to work on post WWII weapons. But the growth of computers and microcircuits has spurred new research on the WSM.
Milo Wolff in 1985 began the first mathematical theory of the WSM using a scalar wave equation with spherical quantum wave solutions. He found the Wave Structure of Matter described in his earlier book (1990) *"Exploring the Physics of the Unknown Universe – An Adventurer's Guide* and this book. It successfully predicted the natural laws and the properties of the electron. This web site continues that work on the natural laws including a derivation of gravity and the physical origin of spin that accords with experiment, quantum theory and the Dirac Equation). It completes the structure of the electron and its waves and extended applications to cosmology.

New pioneers. Many younger physicists have begun to explore the WSM further; most of their work is published on the Internet, including **Geoff Haselhurst** in Australia who has extensively explored (1998 to present) the philosophical background of the WSM shown on his entertaining and deeply researched website: SpaceAndMotion.com
Mike Harney in industry (michael.harney@signaldisplay.com) has found a way to derive the light-speed c of quantum waves treating space as an elastic quantum medium (with potential energy) and with moving mass-density (kinetic energy). This is the first understanding of this important fact of Nature and the wave-medium. **Mike Weber** working on a USN submarine, created a mathematically accurate and beautiful graphic 3D view of the in-out waves (a standing resonance) of the electron:

http://ryanhagan.net/mike/StandingWave3D/StandingWave3D.htm

The animation allows the user to display the effects of Doppler and interference between two electrons. Choice parameters are time, relative velocity, and either positron or electron.

Industrial microcircuits and electrodynamics

Akira Tonomura of the Hitachi Corp published in 1998 *The Quantum World Unveiled by Electron Waves* (World Scientific Press), a beautifully illustrated book that discusses the quantization of flux at low temperatures in a closed loop of real electron waves. Quantization occurs because the waves of the circulating electrons must join in phase, otherwise they cancel each other.

Carver Meade, Professor emeritus at the California Institute of Technology (Caltech), investigated electron waves in his 2000 book *Collective Electrodynamics* published by MIT Press. His work has been used and supported by the Intel Corporation. He recognized that the electron is not a point particle but a wave structure, and that e-m approximations, especially in magnetism, do not work at quantum dimensions. He used the measured effect of wave structure at low temperatures (termed the Quantum Hall-effect) that the magnetic flux f in a closed loop of current takes only quantized values: Flux = nf, where n is an integer. This is because the waves of the circulating electrons must join together in phase, otherwise they cancel each other. He derived a vector potential to correct the flawed magnetic terms of Maxwell's Equations, using measurements of electron waves in closed loops. Recall that Einstein pointed out the flaws of Maxwell's Equations long ago but science had to wait 40 years before Meade corrected them. His book, very popular in Silicon Valley, shows correct ways to solve the electromagnetism of transistor circuits. MIT awarded him the Lemelson-MIT Prize ($500,000) in 1999. Meade felt that the failure of the physics community to recognize the WSM was a serious omission. He wrote: *"It is my firm belief that the last seven decades of the twentieth century will be recorded in history as the dark ages of theoretical physics."*

In an interview (American Spectator, Sep/Oct 2001, Vol. 34 Issue 7, p68), he stated: "*The quantum world is a world of waves, not particles. So we have to think of electron waves and proton waves and so on. Matter is 'incoherent' when all its waves have a different wavelength, implying a different momentum. On the other hand, if you take a pure quantum system - the electrons in a superconducting magnet, or the atoms in a laser - they are all in phase with one another, and they demonstrate the wave nature of matter on a large scale. Then you can see quite visibly what matter is down at its heart.*"

New opportunities.

The simplicity of the WSM provides easy access to the behavior of materials whose properties depend on their structure at the atomic level. This was not possible using the discrete particle model of matter because many materials presented property enigmas that were not understood. Using the WSM permits research of the material wave structure that joins atoms within the material and with external material. This knowledge and ability to calculate is can produce rewarding results. Probable cases are below:

1. **Graphene.**

This is a newly discovered form of graphite that exhibits unusual behavior not currently explainable using the discrete particle approximation. It occurs in flat sheets of carbon atoms, and in rolled-up sheets termed *'nanotubes'.* These sheets and tubes have extremely low electrical resistance and are being considered (2006) for use in microcircuits.

The current graphene enigma using the discrete particle model is described as:
Graphene contains quasiparticles. They are of a type known as massive chiral fermions. Chirality refers to "handedness", in that the left hand is the chiral opposite of the right hand. Unfortunately, discrete particle physics predicts that any particle that has chirality cannot have mass, so a massive chiral fermion is a contradiction in terms."

Graphene can be an opportunity for wave-matter theory to explain. It can be experimented on easily at room temperature, so predictions might be testable.

2. **Magneto-resistance (MR) devices.**

Magneto-resistance occurs when a magnetic field applied to a semiconductor, changes the resistance of the semiconductor and thus the current that can flow through it. There are

The giant MR is commonly used in the read-write heads of modern high-speed disc memories. A usual design is to build two ferromagnetic layers that sandwich a layer of non-ferromagnetic semiconductor. The magnetism of one ferro layer is a fixed magnet and an outside field orients the other layer, perpendicular to it. When the magnetic fields of the two layers are parallel, the resistance of the inner layer is very low and a large current flows. The resistance change is very fast - about 0.1 nanosecond permitting rapid data entry and retrieval.

Recently an even faster MR has been found (Scientific American, July 2004) termed **Extraordinary MR** (EMR) that depends on the geometry of the 3 layers, one of which is a conductor between the two semiconductors. This produces a time constant of about 0.001 nanosecond, 100 times faster. An imposed magnetic field causes electrons to travel spiral paths thus lengthening the travel time between collisions and increasing the resistance.

It is well known (See Carver Meade, 2000) that the usual equations for magnetism are a poor approximation so that using the WSM, better calculations can be made of the magneto-resistance effect.

Biology and Genetics. The techniques of manufacturing semi-conductors are beginning to be applied to building organic devices using biological parts. It is possible (*Engineering Life,* Scientific American, June 2006) to synthesize DNA strands from their constituent basic four molecules: adenine (A), cytosine (C), guanine (G) and thymine (T).

Although DNA is a very long molecule – millions of basic units – the basic units are just two simple pairs of the basic four molecules: AT and CG. These unit-pairs form the rungs of the enormous DNA ladder molecule. It is amazing that the genetic code that contains the key instructions to grow every form of life is contained only in the billions of possible arrangements of the millions of pairs on the ladder. How did Nature learn and arrange the mathematics of probability that distinguishes one living organ from another – an ear from a tooth, for example? Again we see that Nature is binary, and that complexity in Nature arises out of simplicity.

How did Nature find this scheme of mathematics that underlies the evolution and growth of life? It is even more amazing when you realize that the wave-bonds between molecules must be have just the correct exchange energy to hold them together and yet, when necessary in the growth of an egg into a living organism, the bonds can be separated as required in the presence of other molecules, acids, and bases. Not just any molecule will do – they must be just right in ways that we do not yet understand. Biochemistry science does not yet evaluate the energy of bonding schemes. Standard chemistry merely describes the arrangements of molecules and their behavior. This is because the bonds are *wave structures* not yet widely used.

The use of the WSM may provide greater understanding of the growth of life.

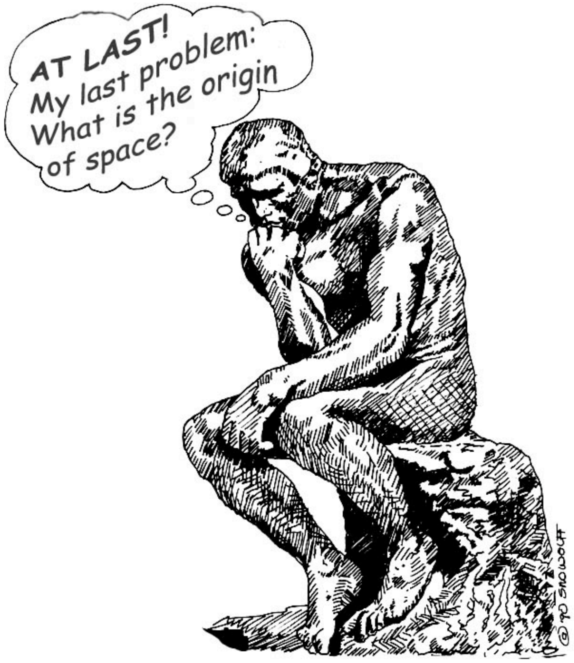
Industrial Alloys. Most of the valuable varieties of metallic alloys – steel, brass, dura-aluminum, etc. that are widely used in industrial applications are simple mixtures of the basic elements – iron, carbon, copper, zinc, aluminum, etc. Their properties have been discovered by trial and error over centuries of smithing, weapon building, and industrial metallurgy. In principle, if one knew the way the elements of the mixture joined together, we might be able to design alloys for specific purposes instead of using trial and error. This is now possible because the alloy bonds are *wave structures*.

Energy storage devices. The common flashlight ‘battery’ and the sophisticated storage devices of the modern hybrid car are chemical mixtures of two elements whose binding energies are different. The difference is the voltage of the battery. Just like the history of alloys, these energy differences are empirically measured, as well as the behavior and stability of the two elements. Again, if one knew the way the elements of the mixture joined together, we might be able to design batteries for specific purposes, by calculation using the WSM.

The future of the WSM will require new techniques of application, calculation, and design. These applications in the future are for you the reader. But I hope I can help!

The final single task of theory is to understand the origin of space. What is space? Why does it have the strange feedback property also found prominently in General Relativity? This is the final frontier, illustrated below.

Good luck.



What is the origin of space? We know almost nothing about it except its two properties; Principle I and II. Perhaps we are not entitled to ask more since these two properties lead to all our fundamental knowledge of matter and the natural laws.
The most perplexing aspect is its self feed back; that the density of space determines the form of matter (wave-centers), and conversely, every wave-center (matter) contributes to the density of space in the Universe. If there is a God, this is it.

The End