

# No Government Funds for CSS Research

## *DARPA sees FORMS as threat to theories of Modern Physics*

A US government agency chartered “to conduct high risk/high payoff R&D for the Department of Defense” offers grants and recently invited proposals for “electromagnetic modeling and simulation” and “modeling of materials.” Common Sense Science submitted a White Paper on FORMS to the Defense Advance Research Projects Agency (DARPA) who promptly reviewed and rejected our electromagnetic approach to modeling and simulation of materials.

The evaluation panel “recognized the merits of the work outlined” in the proposal submitted by CSS and also acknowledged that “the proposal addresses an area that is of interest to DSO (Defense Science Office).”

The Grants Notice posted February 8, 2005, by DARPA as Funding Opportunity Number BAA05-19 requested “research and development in a variety of enabling technologies, including...electromagnetic modeling and simulation,” “revolutionary rather than incremental improvements,” “investigation of the interactions between physical forces, material, and biology,” and “novel approaches for manufacturing and self-assembly of materials and structures.” The White Paper on FORMS sent for review to DARPA is fully responsive in these areas.

Furthermore, the White Paper showed why our *deterministic approach to design of new materials* is superior to prevailing methods, and we cited experimental evidence in support of this claim. Moreover, we referred to scientific documentation that shows our physical theory makes more accurate and complete predictions than Quantum Electrodynamics (QED).

The CSS proposal was rejected by DARPA as a threat to the theories of Modern Physics. The DARPA notice to CSS states:

The proposal addresses an area that is of interest to DSO, but there are specific problems in the technical approach that preclude further consideration. These problems include: Basically they try to make an argument [*sic*] that quantum mechanics, relativity, *etc.*, are incorrect despite QED being the most accurate [*sic*] theory yet developed. They provide no evidence for such a claim and to accept their premise would require abandoning all physics of the last 150 years [*sic*].

Common Sense Scientists had the following reactions to the DARPA notice:

Glen Collins commented:

I'd like to see their evidence that quantum electrodynamics (QED) is the "most accurate theory yet developed." What hogwash! Also, 150 years is stretching it by about 70 or 80 years beyond quantum anything.

So, must we attack QED (*i.e.*, show copious evidence that it is in error) before being heard? My general view is that 'attacking' anything is less desirable than promoting what is good. However, ...should we "destroy" QED, SRT, GRT, *etc.* since all of these theories are used to deny God and promote a totally material universe? Again, my leaning is 'no' due to our limited resources and time. Many have attempted to point out the errors of the standard theories to no avail. Promoting the success of a new theory is the best option to pursue in my opinion."

Edward Boudreaux commented:

Quite frankly, I'm not at all surprised by this response. It is the main stay of the scientific community in general, thus it is futile to attempt obtaining grant funding from any of the established scientific agencies. What needs to be done is to maintain contacts with private individuals having adequate funds that are sympathetic to the cause. I don't believe any other approach is likely to be successful.

Dave Bergman commented:

DARPA is too committed to Modern Physics to consider our alternative approach. We will continue our development of FORMS. Perhaps other sources of financial support will be forthcoming. I am thinking about publishing the "White Paper on FORMS" in order to explain our approach and and make known the need for development funds.

The White Paper on FORMS is a detailed explanation of the FORMS program. The full text follows:

(continued)

# Forms Of Real Molecular Structures (FORMS)

Simulation of Atomic, Nuclear and Molecular Structures

Common Sense Science, Inc. (CSS) presents this White Paper in response to the Grants Notice, Funding Opportunity BAA05-19, posted February 9, 2005. Our response addresses many Technical Topic Areas of Interest to DSO—but most directly is categorized as *electromagnetic modeling and simulation* and *modeling of materials*.

**FORMS Computer Simulation.** FORMS is a computer simulation of the *structure* and *movements* inside real molecules. Improved knowledge of structure in materials leads directly to improved predictions of the chemical, physical, and electrical properties and widespread applications. Knowledge of internal motions inside materials can reveal how process rates and material states are affected by temperature or radiation, *etc.*

FORMS simulates actual positions and motions of *physical* material particles. Three theories developed by CSS provide the underlying physics that permit the simulation of real molecules. These three theories, combined into one unified theory, make up the CSS Electromagnetic Theory of Matter:

1. Bergman's Spinning Charged Ring Model of Elementary Particles [1-4].
2. Lucas's Physical Model for Atoms and Nuclei [5].
3. Weber-Lucas's Force Law for Finite-Size Elastic Particles [6].

CSS Electromagnetic Theory of Matter. Common Sense Science's modeling and simulation have been successful using the postulate that *atomic and molecular structure is electromagnetic in character* [7]. This view was widely held prior to the Twentieth Century but currently may be considered either radical or passé by adherents of the popular models of Modern Physics. Nevertheless, by strictly adhering to careful Scientific Methodology, the CSS Electromagnetic Theory of Matter leads to more accurate predictions of fundamental physical phenomena than prevailing theories such as those utilizing Quantum Mechanics, the Standard Model of Elementary Particles, the Heisenberg Uncertainty Principle, and the Theories of Relativity.

Bergman's Ring Model of Elementary Particles [1-4]. Electrons and protons are the common elementary particles used in the CSS model of atomic and molecular structure that is implemented in FORMS. In this model, both electrons and protons are posited as spinning charged rings—particles with size, shape, and boundaries whose properties are known from experimental and theoretical work of Parson in 1915 [8], Compton in 1919 [9], Iida in 1974 [10], Bostick in 1985 [11], and Bergman and Wesley in 1990 [1].

In contrast to particle abstractions such as an infinitesimal “point-particle,” a Spinning Charged Ring is a *physical object*, composed of one or more charge-fibers circulating about the surface of a thin ring with rim velocity equal to  $c$ , the speed of light. As spinning charge rings, electrons and protons are stable because the outward-directed electrical

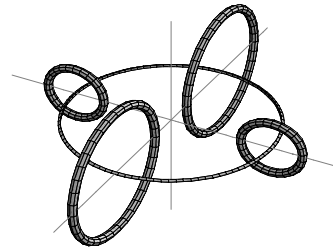
Coulomb force is balanced at all times by the magnetic pinch force of moving charge. Subsequently, each ring has real physical properties of size, shape, and boundary conforming to the known physical properties of particles. In this manner, a single physical model is used for both electrons and protons, an approach that proves more useful for simulation than the quantum point-particles postulated by prevailing popular theories. Because energy is always conserved in empirical observations and in classical electrodynamics, our physical Ring Model approach (in simulations of energy, forces, positions, *etc.*) leads to accurate predictions more precise than is possible with stochastic quantum models or other standard model-based calculations.

Lucas's Physical Model for Atoms and Nuclei [5]. Real atoms and molecules, composed of physical electrons and protons that occupy actual positions in a molecule, *can be simulated* by applying an accurate electrodynamics force law to Lucas's Physical Model for Atoms and Nuclei. Figure 1 illustrates a molecule of hydrogen whose basic structure was determined by this method[7].

Weber-Lucas's Force Law for Finite-Size Elastic Particle [6]. The third theory needed by FORMS is a force law that is accurate under dynamic conditions, *i.e.*, internal motions of the particles that compose a molecule. Considerable research by CSS has produced Weber-Lucas's Force Law for Finite-Size Elastic Particles which is more accurate than all preceding force laws for various velocities and angular relationships between charged particles.

**Model of Actual Dynamical Structure.** In Lucas's Physical Model for Atoms and Nuclei [5], particles within an atom are not in orbit nor randomly located but rather vibrate (depending on Kelvin temperature) about fixed positions at various angles and distances from the center of the atom or molecule. The actual shape and position taken by a particle is determined by a balance of all electric and magnetic forces over the surface of each particle. Therefore, the location of a particle is not probabilistic, but definite—in keeping with the classical laws of *cause and effect* and *energy conservation*. In contrast to the wave-particle objects of Quantum Theory that are purported to be subject to random-chance motions and positions, the CSS model of atoms and molecules is deterministic, and computations by FORMS disclose the forces on, locations of, and velocities of each particle. In situations where a subatomic particle does not converge to a stable equilibrium position, with a minimum potential energy, the simulation keeps track of the particle's velocity, position, and potential energy at each time instance of the simulation.

FORMS will simulate the motions of all particles that compose a molecular structure by



**Figure 1.**  
Hydrogen Molecule (H<sub>2</sub>)  
(not shown to scale)

Two ring-electrons (the larger objects) and two ring-protons combine to form a molecule of hydrogen gas. Measurements of bound electron and proton magnetic moments reveal that the proton is 658 times smaller than the electron. The principal line of magnetic flux links the four rings together.

Each particle takes up positions and angular orientations to achieve a minimum energy potential.

the use of a new and accurate electrodynamics that is free of newly-discovered problems inherent in Maxwell's Equations and Special Relativity Theory[6]. This feature of FORMS adds dynamic realism to the simulation results—with the capability to predict effects of temperature, bombardment, and external fields on a molecule's structure and properties.

**Expected Benefits.** We expect to use FORMS to systematically compute various properties of selected atoms and molecules, and to ultimately develop new materials with specific properties needed in every aspect of science, technology, and industry. We anticipate that “designer materials” for military use, medicine, building, fabrication, energy production, etc. will be discovered *by relating the chemical, electrical, and physical properties of a material to its atomic and/or molecular structure.*

We expect to use FORMS to systematically compute the bonds that tie atoms together within a molecular structure and to guide researchers in the successful synthesis of new materials. FORMS will be used to simulate any material (taking longer to simulate heavy elements and complex molecules), and an expected benefit of FORMS in the proposed research program will be significant improvements in materials technology for uses such as making, cutting and polishing superhard materials. FORMS will be able to simulate actual structures and accurately compute internal binding forces that determine such properties as hardness, elastic and plastic deformability under load, volume compression, linear compression, and density.

FORMS will compute structural molecular deformations that are caused by forces from external electric and magnetic fields, *i.e.*, FORMS will reveal the internal effects in atomic and nuclear structure. Thus, FORMS can guide researchers in forming new molecules by synthesis, fission, or fusion. The following benefits are expected from use of FORMS when it can be used to study matter:

1. Increased knowledge of atomic, nuclear, and molecular structures.
2. Accurate description of molecular forces, fields, and motions.
3. Discovery of material properties not previously recognized. An expected benefit from the use of FORMS is *identification* of materials with specific properties needed in every aspect of science, technology, and industry.
4. Syntheses of materials, *e.g.*, fusion, alloys, crystals, synthetic materials. Researchers will be guided by increased knowledge of binding forces and processes that FORMS computes and displays. An expected benefit from the use of FORMS is formation of materials with specific properties needed in every aspect of science, technology, and industry.

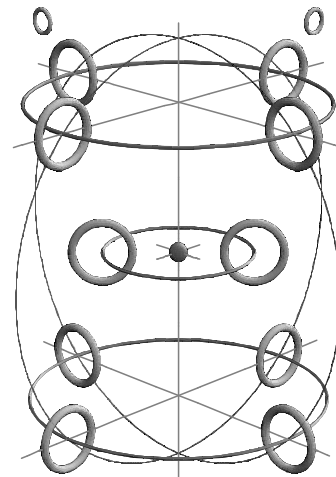
**Predicting Properties of Materials.** Our approach facilitates *predictions of a material's properties from its physical structure.* A few examples follow to illustrate our method.

Some well-known properties of water seem obvious from an inspection of Figure 2:

1. A water molecule is *bipolar*, with net positive charge at one end provided by the location of protons. At the other end, the net charge is predominately negative from an abundance of electrons.
2. Water molecules *tend to form chains and clusters* from the attraction forces of “opposite charge” between ends of bipolar molecules.
3. Water will be a *solvent* in many materials because weakly-bound materials with electrons in their outer shells will be attracted to water’s protons more strongly than they are held back by their neighboring molecules that tend to electrically repel each other.
4. Water will rise and overcome gravity in a thin glass tube (capillary action) because the protons of water in close proximity to electrons in a glass tube are strongly attracted to one another.
5. It is easier to “turn a page” in a book if a finger is moistened with water, because protons on a wet finger attract electrons in paper, but electrons of a dry finger repel electrons in paper.

These five predictions of properties of water could also be discovered (and were discovered) by experimentation or observing the results of manipulations of water. Experimentation to determine the properties of any material is useful and very common, as in laboratory and clinical tests of medicinal drugs. In the Nineteenth Century, experimentation was a reasonably efficient method for discovering chemical properties of materials. Recently, however, discovery of material properties has become less efficient, especially where nuclei and larger molecules are being observed. New discoveries in chemistry are slow and expensive when a “mix and measure” approach is used and then repeated with variations in temperature, pressure, mixture, impurities, *etc.*, until the desired result is obtained or success seems impossible.

In complex environments, where many interactions are operating simultaneously, a simple experimental approach for discovery of properties is inefficient and often incapable of revealing hidden factors. In such cases, the use of simulation (incorporating theory, structure, and prediction by the relationship of properties to materials) is important for success



**Figure 2.**  
CSS Concept of a  
Water Molecule (H<sub>2</sub>O)

The nucleus occupies the center of the molecule.

To a first approximation, electrons are located on great circles, as illustrated. Actual positions of the electrons will be computed by FORMS by the use of Electromagnetic Potential Theory to find the locations that provide the minimum energy potential of the molecule.

Two electrons occupy the first shell. Eight electrons in two stable groups of four occupy the second shell. Two protons, from two hydrogen atoms, occupy the outer shell.

and efficiency in materials technology advances. We anticipate FORMS will become a much-needed tool to revolutionize the fundamentals and technology of materials science.

**Superior Approach to Design of New Materials.** Previously, Quantum Models, property classification techniques, and approximation methods have been used to design and synthesize materials with desirable properties.

Model of Elementary Particles. Quantum Theory and the Heisenberg Uncertainty Principle (HUP) require atomic, nuclear, and molecular electrons and protons to take random positions and velocities that prevent a deterministic molecular structure. However, Badolato, *et al.*

“demonstrated a *deterministic* approach to the implementation of solid-state cavity quantum electrodynamics (QED) systems based on a precise spatial and spectral overlap between a single self-assembled quantum dot and a photonic crystal membrane nanocavity.... This approach removes the major hindrances that had limited the application of solid-state cavity QED and enables the realization of experiments previously proposed in the context of quantum information processing”[12, emphasis added].

Unlike Quantum Models, the physical models in FORMS are completely deterministic. Successes demonstrated by Badolato, *et al.* [12] strongly suggest the need for a causal, deterministic model and theory, and they provide empirical evidence for the fundamental premises of FORMS: *matter has a real, physical existence, a structure that can be simulated, and properties that can be predicted.*

Inter-Molecular and Internal Binding Forces. Binding forces between molecules—and between the component particles within a molecule—play a dominant role in the size, shape, and structure of molecules. Kaner, *et al.*, list types of binding forces that are said to contribute to properties of super-hard materials: covalent bonding, ionic, and metallic bonding[13]. Covalent bonding, where two electrons “occupy a single orbital”[14] is a Quantum Mechanical depiction with the uncertainty of position specified by HUP. But HUP fails badly and does not describe molecular structure [15]. The newly-developed deterministic force law used in FORMS has been validated by empirical evidence using rigorous scientific methodology [12,16-19].

Selection of Elements. A crucial step in the development of a new material with useful properties (*e.g.*, hardness) is selecting “the best combination of elements”[13]. For example,

“...efforts to design superhard materials can be divided into two main approaches. In the first, light elements including boron, carbon, nitrogen, and/or oxygen, are combined to form short covalent bonds. In the second, elements with very high densities of valence electrons are included to ensure that the materials resist being squeezed together” [13].

Our initial approach to selection of elements is the first of the “two main approaches,” *i.e.*, start with “light elements”[13] if material hardness is needed. However, once the selection of elements is made, FORMS will quickly and efficiently determine the exact structure and binding forces of other candidate designer-materials by simulation rather than a costly and time-consuming method of making a new material and measuring its properties.

**Likelihood of Success.** We confidently expect FORMS to become a widely-used scientific and technological tool for predicting useful properties of materials. The CSS Electromagnetic Theory of Matter [1-7] is foundationally based on two general laws (that are related), these two being *cause and effect* and *conservation of energy*, and the laws of electromagnetics, *i.e.*, the force laws of Coulomb, Ampère, Faraday, and Weber. These laws and electromagnetic field theory have been used to develop and apply the CSS Electromagnetic Theory of Matter that successfully predicts the fundamental properties exhibited by elementary matter-including inertial mass, spin, and magnetic moment. We expect success because our models and theories do not have internal contradictions or errors-in-logic that characterize leading theories of popular Modern Physics [6, 16].

We are confident of the physics in our theories and force laws. We have tested many predictions made by our model of elementary particles, and consistently found that the predictions were validated by a vast amount of empirical data. For example, our predictions of *line spectra* [16, 17], *nuclear half-lives* [18], and *spin* [19] are more accurate and complete than the predictions found in books and journals of physics. *Having demonstrated that our physical model of elementary particles successfully predicts chemical, electrical and physical properties, we are sure that the same approach will succeed with our physical models of atoms and molecules.*

We are also confident of our ability to simulate materials by applying electrodynamics theory to our physical models. This confidence stems from successful prototype simulations of very simple materials (neutrons and hydrogen molecules). To date, *both static and dynamic simulations with three degrees-of-freedom have been verified.* Simulations with more degrees-of-freedom will incorporate the same algorithms that succeeded in the prototype version. The FORMS simulation can be completed without the need for new discovery in theory or modeling.

Our models and theories have been presented and favorably received at many national and international conferences. They are documented in a refereed journal of physics, conference proceedings, and the quarterly journal of Common Sense Science, FOUNDATIONS OF SCIENCE, published for the past eight years.

We have evaluated computer programming languages to find which is most suitable for the simulation and graphics displays generated by FORMS. C++ has been selected as the primary FORMS programming language based on the availability of programming tools, numerical precision of computations, compatibility with Super-Computers, experience of leading programmers, and support for data abstraction.

## Key Personnel.

- David L. Bergman, BA (Physics, Un. of California, Berkeley), MS (Electrical Engineering, Un. of California, Santa Barbara). Mr. Bergman has 7 years experience in design and development of electromagnetic devices and 23 years experience on electronics (radar and sensors) systems of military weapons. He is recognized internationally as a leading expert on electrons and protons[3]. He developed the algorithms used in prototype versions of FORMS for the dynamic simulation of subatomic particles.
- Charles W. Lucas, Jr., Ph.D. Dr. Lucas earned his doctorate in Theoretical Physics from The College of William and Mary at Williamsburg, Virginia, and then performed post-graduate research on elementary particles at the College. He was a professor of physics at Catholic and American Universities in Washington. He derived the electrostatic force law used in FORMS to calculate forces between particles. He refined the Ring Model by the concept of split charged-fibers that explains all the elementary particles of the Standard Model with a classical electrostatics approach [4].
- Glen C. Collins, Ph.D. Dr. Collins earned the Ph.D. degree from Vanderbilt University for research in Artificial Intelligence and Software Engineering. He earned the MSEE and BEE degrees in Electrical Engineering at Georgia Institute of Technology. From 1990-1992 he was Assistant Professor of Electrical Engineering at the US Naval Academy and Research Consultant at Naval Research Laboratory. He has recently worked with various Navy supercomputing projects and classified information warfare programs, and has served as Program Manager on several important military satellite communications projects.
- Edward Boudreaux, Ph.D. Dr. Boudreaux holds M.S. and Ph.D. degrees from Tulane University. He is Professor Emeritus at the University of New Orleans, where he spent 29 years in graduate/undergraduate education and basic research, in quantum chemistry and chemical physics. Dr. Boudreaux has in excess of 45 publications in refereed scientific journals, a number of comprehensive reviews, plus several contributions as author/co-author, contributor to books. His field of specialization is electronic structure and chemical bonding in molecular systems and condensed media, stressing calculations of various electronic, magnetic and spectral properties.
- Gary Elsesser, Ph.D. BS (Mathematics, Computer Science, Un. of Wisconsin, Madison); MS (Computer Science, UW, Madison); Ph.D. (Computer Science, Un. of Minneapolis). Dr. Elsesser performs research in compiler optimizations for parallel and vector machines. He has a strong background in programming languages and software design. He spent 13 years at Cray, Inc., doing compiler R&D, and he works with Cray X1 systems on a regular basis.

## **Program Phases, Estimated Costs, and Duration.**

Completion of Phase 1, shown below, establishes an operational FORMS simulation and applies the simulation to two simple forms of matter. Phase 1 is estimated to cost \$791.5K and take 18 months to complete. Additional phases are shown to enhance FORMS and apply the simulation to research on important materials. Critical issues on the path to success are shown in **bold face type**. Deliverable items under a procurement contract are underlined. The five phases of the FORMS program can be overlapped for funding at one-year intervals and completion in five years.

**PHASE 1.** Create FORMS Version 1.0 Simulation. \$791.5K. 18 months.

Part a. Program Elements Definition. **Fundamental algorithms will be created, geometry of molecules will be defined, and program structure will be created. These elements will be integrated into a dynamic simulation with 7 degrees of freedom (3 linear positions, 3 angular positions, 1 dimension of particle size). Program code will be written to simulate particles as deforming structures whose dimensions depend upon the ambient electromagnetic field environment. Algorithms and program code will find configurations of minimum energy potential, where all forces are in balance. A means of timed updates to reposition particles will be implemented in the prototype simulation program.** The neutron (a specific configuration of an electron and proton) and diatomic hydrogen will be simulated in this phase. Beta-decay of a neutron will be simulated to determine its structural conditions of stability (and instability), its disintegration time, velocities, equivalent half-life, and the tracks of the elementary particles.

Part b. Conversion to C++ Program Language. **This effort will create C++ program code** from prototype code written in another program language (used to develop algorithms, basic program structures, display techniques, *etc.*).

Part c. CSS will analyze the neutron and hydrogen simulation results, relate them to measured properties, and document the simulations and the results of the analytical studies.

**PHASE 2.** Program Enhancements and Application to Small Molecules. \$817.9K. 18 months.

Part a. Usability. **Create a user-friendly interface, library file structures, and graphics that display the simulation and computed properties of a molecule. CSS will develop techniques and program code for display and visualization of the particles and their three-dimensional electrical fields and molecular structures.** The display will show the locations of electrons and protons in nuclear and atomic shells. The electric and magnetic fields of an atom or molecule will be overlaid on the display of the material object. Other graphics will show how molecules and/or elementary particles are bound together by lines-of-force. CSS will document graphics features of FORMS Input and Output capabilities and illustrate graphics with examples.

Part b. Upgrade FORMS with advanced features, including split charge-fibers (and **more degrees of freedom**), external fields, synthesis features for combining atoms into molecules, and **interface to Super-Computers**. CSS will document the advanced features along with the FORMS Input and Output capabilities. CSS will analyze and document the results of simulating split charge fibers with regards to stability of electrons, protons and neutrons.

Part c. **CSS will simulate helium and a water molecule and analyze the results to predict material properties of water.** One example of analysis is a study of the bonding forces between atoms and molecules. Bonding strengths and stability will be examined from the ambient fields that are computed and displayed. CSS will document the results of this analysis.

**PHASE 3.** Simulations and Analyses of Nuclides. \$525.8K. 12 months.

**CSS will simulate and analyze two (or more) stable nuclides** and two (or more) radioactive nuclides, compute nuclear binding energies and make prediction of nuclide half-lives. CSS will document the results of these studies.

**PHASE 4.** Bonding in Compound Molecules. \$792.5K. 15 months.

**CSS will optimize FORMS for faster processing by algorithm improvements and by use of super computers.** CSS will select a compound “deserving further study”[13], e.g.,  $C_3N_4$ ,  $B_4C$ , or  $B_6O$ , to simulate and analyze binding forces, hardness, and shear modulus of the compound. **CSS will use FORMS simulations to identify the structural features and technology that facilitate the formation of solid state materials, particularly superhard materials.** CSS will write a technical report on the simulation, analysis, bonding properties, and technology of one or more selected compounds.

**PHASE 5.** Chemical and Physical Processes. \$1,002.6K. 18 months.

**CSS will study and identify factors that affect physical and chemical process rates** and enhance FORMS to predict state transitions, e.g., reaction rate or energy loss of a radiation. CSS will write technical reports of the simulation and analysis of molecule properties in dynamic conditions. CSS will also report on the efforts to increase processing rates and provide quantitative measures of the improvements.

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