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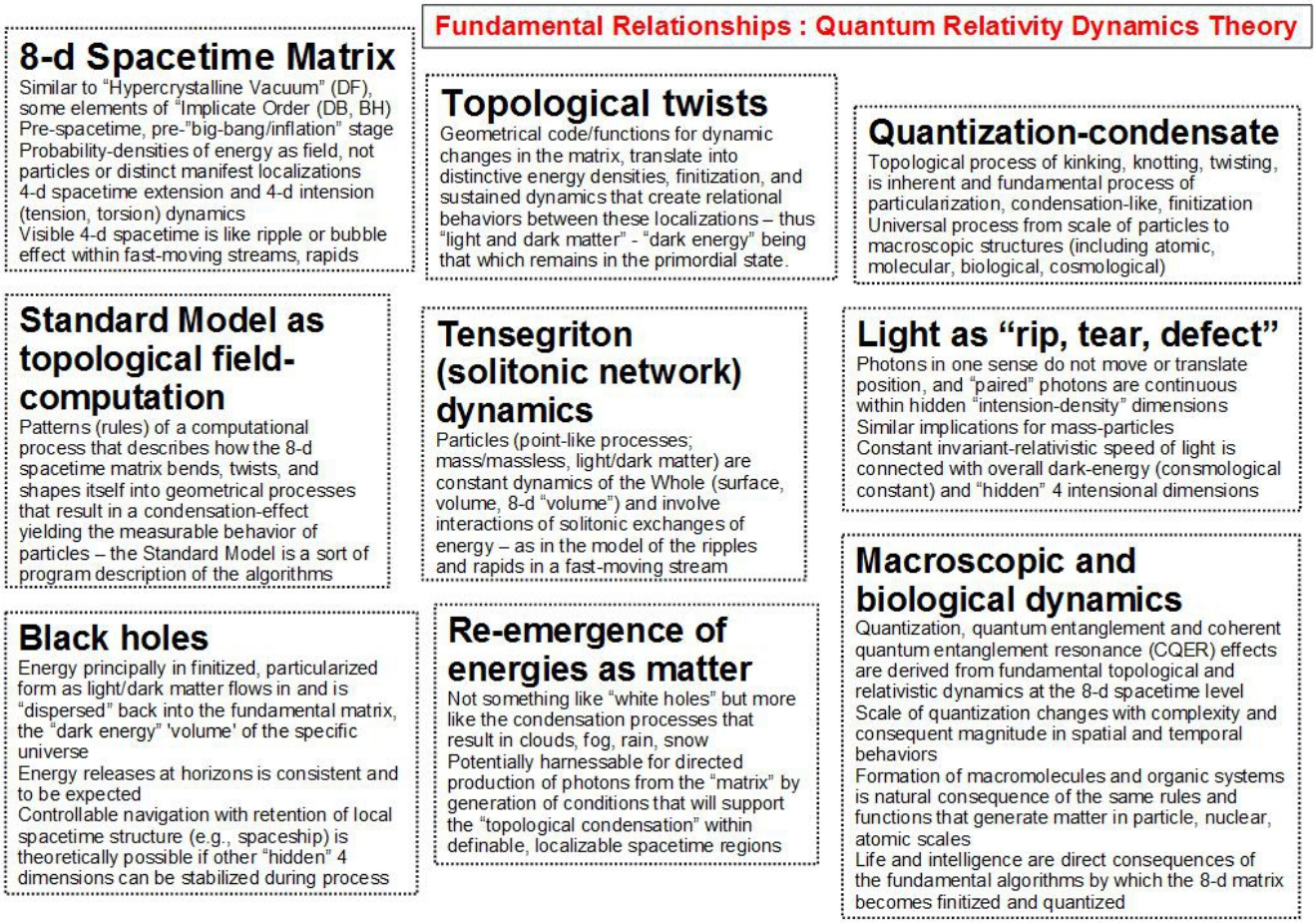
Primary Concentration Fundamental Space-Time Theory, *Quantum Relativity and Gravity, and applications to Quantum Computing Architectures - Stabilization, Coherence and Propagation, CQER (coherent quantum entanglement resonance).*



Secondary Concentration *Applications of intelligent computing (AI, machine learning), parallel distributed systems and quantum computing for space-based mission and support systems*

Comments mainly with respect to Quantum Computing:
Quantum computing ("QC") systems that have begun to reach the stage of experimental implementation and testing range widely from adiabatic architectures to more "classical" quantum logic gate and quantum circuit designs, emergent and promising work in topological quantum computing models, and investigations based upon quantum chaos and turbulence including trapped ions and sustainable, repeatable cascade effects on similar bases. Fundamental challenges exist in the areas of noise mitigation and stabilization of qubit networks (arrays) during the sustained period of times required to complete algorithm processing. The "QC problem" is critical for all current qubit and system-level designs and impacts the application of QC for real-world application tasks. My research beginning in quantum and relativity theory has been directed increasing at solving this "QC problem" of stabilization, sustainability and consistent reproducible measurement.

Stabilization and maintenance of qubit-network coherence is a current impasse barrier that must be overcome in order for QC to evolve into systems that can provide reliable and stable performance for different classes of problems and for performance over time and in diverse physical operating environments. Propagation of coherent "quantum geometries/topologies" from one region of a closed system to another, or between QC systems, is another critical issue, one in which investigations turns to biology and also fluid dynamics as a high-possibility for illumination and inspiration for solutions.

In addition, many of the other scientific investigations in diverse fields - physics, astrophysics, molecular biology, epigenetics, nanostructured materials, to name a few - can arguably be said to certainly benefit from (if not require) QC in order to progress from "present early/speculative theory stages" to mature theory, practical experimental validation, and useful applications. This is arguably the case also for certain critical optimization, search and decision problems of international security, public health, environmental management and crisis response, space exploration, and also novel energy generation and power technologies.

Current attention is strongly directed at defining physical and algorithmic methods that can employ an "inverse" model of how noise and decoherence is used. This moves away from classical "Turing computing machine" concepts and closer to biology, and specifically the coherent propagation of information in both neuro-motor communications and the immune system. "Noise" - the disrupter of QC - may actually be translatable into cybernetic value for control, modulation, and stabilization, removing the need for complex and unwieldy error-correction qubit arrays and opening the gateway to very large scale interactions among independent qubit entanglement sets. The area of investigation known as CQER is of particular interest for not only QC per se but also the implications for quantum relativity and gravity as well as the implications and derivations of the same for both the Standard Model and Cosmology. Recent work also includes a fractal recursive computational model and its expectations for physical implementation using cellular-type field arrays that incorporate BEC (Bose-Einstein Condensate) properties.

Additional comments in Appendix

Contents

Current, Closely Related Projects and Engagements

Fundamental:

- T**urbulence and chaos models** -- methods of identification and control of transition states (aerodynamics, fluids, semi-solid materials)
- **Topological dynamics, macroscopic quantum effects** -- coherent quantum entanglement resonance, quantum relativity models, high-temperature Bose-Einstein condensates

Applied:

- **MOSES** and **ASTRIC** (modular robotic architectures for space-based or remote-environment engineering and construction, including asteroid reconnaissance and collision-avoidance intervention)
- **PodAtrium** and **Bio-Study-Lab** (modular systems for robotic and human use)
- **CyberMod** and **CUBIT** (analytical chemistry and diagnostics instrumentation; multi-spectral design)

Selected Long-Term Research Projects and Accomplishments (Theory+Applications)

Quantum Relativity (models of spacetime topological dynamics at elementary quantum scales and the relationship of such processes to emergence of quantifiable phenomena associated with elementary particles, force-carriers and the epiphenomenal distinguishing characteristics of matter and dark matter. Emphasis upon emergence/sustainability of the Standard Model, not a departure from observed experimental physics but an explication of its features, deriving fermions and bosons as topological anomalies within a fundamental pre-differentiated space. Particular attention is directed to skyrmion-like models and tensegritons (resonant and mutually sustaining solitonic networks) interacting as energetic processes operating in a 4d space and creating spacetime differentiation regions, field-like non-equilibria (warps, defects, twists) that present the observational properties of mass/massless particles and the topological attributes of strings and branes.)

(and closely coupled)

QSNR (ongoing research program in quantum topology and solitonic networks, an area of study within principally theoretical physics (see above) and having application to other domains including macroscopic coherent quantum field effects with relevance to biomolecular signaling and control, self-organizing systems and molecular/quantum-scale computing. Developing

presently into theoretical model of intracellular signaling and epigenetic control – Topological BioDynamics.)
See also **http://instinnovstudy.org/leapsintro.php** (LEAPS Lab), **http://library.instinnovstudy.org**
Mathematical and computational research as part of an international collaborative project
Computational modeling/simulation (Mathematica, Maple, Macsyma, Matlab, SnaPea, Regina, CurvedSpaces, t3m)

i3DAT (exploratory research and adaptation of nonlinear and inverse method mathematics and models for imaging and 3D control and stabilization in applications for robotic control (vehicles, satellites, also for radiology, surgery and drug delivery)
Algorithm and system design, modeling and simulation – programming, testing and prototype validation

PBC (genomics associative learning project; modification of PALLAS (artificial intelligence logics) and HORUS (knowledge acquisition system); target is an open-access abductive reasoning system using genome data to create automated hypothesis generation and discovery of probable relationship indicators within genetics and epigenetics)
Computational modeling, programming, data acquisition, database design
Mathematical and computational design, implementation (CLISP, SQL, genetic, neural net and PCA algorithms)

PALLAS (fault-tolerant network based upon P2P botnet architecture; dynamic community of parallel cooperative AI agents, for detection and characterization of asymmetric anomalies and cyberthreats, focused upon medical diagnostics, pandemic prevention, behavior forecasting, insider-threat detection, institutional critical infrastructure protection – enabled for other apps)
Computational modeling, programming, simulation, network administration and security
Mathematical and computational design, implementation, testing, data security incl. cryptanalysis

BioProt (analysis, surface bioprotection treatment, monitoring, and training of workers, students, general-public, for preventive measures against a variety of contact/exchange-transmissible pathogens; expanded to collaboration with a clinical team that has developed superior bioprotection for in-body post-op bioprotection re: orthopedic surgery and implant devices/procedures)
Data acquisition and collection, sampling, analytics, verification, statistics, visualization and chem treatment, clinical research and trials planning and management

CUBIT, CRAIDO and Race-to-Resilience (community-centric rapid-response including modular mobile system for biothreat validation, intervention and treatment coordination; primary case study for H5N1, expanded for H1N1 and H7N9, with emphasis on mutation detection & tracking, epidemiological monitoring, social behavior analysis supporting social resilience)
Real-time data acquisition, bioinformatics modeling and testing, web-based CMS, DBMS
Laboratory research, program management, agency/sponsor interfacing and presentation

CommonHealthNet (iMedNet) (one of the first web-based telemedicine networks and early social network communities, linking American medical professionals and students with disadvantaged-nation medical providers; later variants: FuturesGateway, Saño y Salvo, and Medicine for Humanity field gynecology clinics)
Web-based interactive CMS and DBMS with image and video libraries and notification system

Nomad Eyes (chem-bio-rad-threat focused network for detection, recognition, assessment, alert, and response, geared for civilian populations, adapted to influenza and food/water-borne epidemics- both home/institutional use; stochastic distribution, wireless and cellular devices; redesigned and upgraded for functionality with generic smartphones and tablets)
(and closely coupled)
RedBioNet (focus on early-warning biothreat detection in wildlife and rural/uninhabited environments, employing distributed sensor arrays and mixed-media information gathering from local including public sources)
Microsensors, wireless communications, data acquisition, AI, mobile networks, sensor interfaces, and info-security

Selected Social, Educational and Community-Service Projects and Accomplishments (1990s - Present)

- **Manistee STEAM Program** (STEM and arts (STEAM) learning enhancement for youth 8-18 with hands-on engineering projects spanning from automotive engines to aerospace themes and experimental projects)
- **S.H.A.K.T.I. Warriors** (STEM Advisor for youth program serving 8-14 year old children in high-risk urban school districts)
- **Medicine for Humanity** (telemedicine system for international remote-location Ob/Gyn relief program)
- **Futures Gateway** (international internet-based educational teams and clubs collaborating and competing with futures-oriented study projects, for youth 10-18 and family-members as well)
- **Lincos Project** (MIT-led program providing self-contained internet and computing for children in deeply underdeveloped and rural parts of the Western Hemisphere)
- **Jedi and Quetzal** (project undertaken with Center for Advanced Defense Studies for Guatemalan youth)
- **PFP – PODs For People** (emergency relief, medical, educational facilities via modular, mobile Pods)
- **Ubuntu, Atlas Challenge, R4** (related emergency/social relief projects with several humanitarian organizations, serving indigent, rural and/or chronic-disadvantage populations (Americas, Africa, Asia)

Key Positions

§ Co-Founder	Exoplanetary Corporation (2015 – present)
§ Co-Founder / Fellow	Institute for Innovative Study (2006 – present)
§ Chief Scientist / Managing Director	TETRADYN Ltd., (TETRAD Group) (2003 - present)
§ Visiting/Adjunct Professorships	UCR (2001-02); MSU (2002-06); also at U-Pitt, U-Va, U-Tx, Vanderbilt, VaTech, Michigan (2005 – present)
§ Research Scientist & Group Manager	Intel Corporation (2000 – 2003)
§ Director of R&D	Silicon Dominion Corporation (1996 - 2001)
§ Professor (dual departmental appts.)	Virginia Commonwealth University (MCV) (1993 - 98)
§ Senior Scientist	SGS-Thomson Microelectronics (ST Microelectronics) (1988 - 93)
§ Senior Engineer / Project Manager	Martin-Marietta Aerospace (Lockheed-Martin) (1985 - 88)
§ Research Scientist	Battelle Laboratories (1983 - 85)

Formal Higher Education

§ Science Honors Program, Canisius High School, Buffalo, NY

§ BA (high honors), dual-major (Philosophy+Physics), Colgate University, Hamilton, NY

§ Postgrad program in computer science at UCSB and UCLA, Los Angeles, CA

§ MA, Philosophy of Physics (concentration: quantum logics) Johns Hopkins University, Baltimore, MD

§ PhD, Theoretical and Computational Physics, Union Institute and University, Cincinnati, OH (1993)
"Quantum Processes and Dynamic Networks in Physical and Biological Systems"
(doctoral advisors: D. Finkelstein*, D. Bohm, B. Hiley*, R. Penrose, K. Sharpe*, J. Crain*)

Primary Non-Profit Engagements (details available through websites)
IIS – Institute for Innovative Study http://instinnovstudy.org (includes ECOADUNA Foundation http://ecoaduna.instinnovstudy.org)

Professional Experience

§ 2015 - Present: Co-Founder, The Exoplanetary Corporation (Exoplancorp)

This is a long-term entrepreneurial venture that is in its inceptional phase. The goal is to systematically integrate near-term technologies that address manned and robotic missions with very long-term R&D for interplanetary and interstellar missions, doing this in a manner that builds and sustains a sustainable economic platform to continue work that is necessary beyond the scope of one or even a few generations.

The company's mission statement (2015):

> "To produce and sustain the economic, social, scientific, technical means for humanity to extend and build its life beyond the confines of Earth and to do so in a manner that is strategically sound and profitable for the present generation and those near-to-come in addressing both opportunities and needs in the lives of individuals and societies.
> The Corporation engages in basic and fundamental research and product development within materials, construction methods, power and propulsion systems, life sciences, and psychosocial dynamics, that simultaneously serve the very long-term purposes of interstellar, exoplanetary missions and the very near-term needs of society and economics on Earth in the present era."

§ 2006 - Present: Fellow (Co-Founder), Institute for Innovative Study (IIS)

See project activity descriptions in sections above and http://instinnovstudy.org. Primary research interests in quantum macroscopic fields and coherent quantum field theory deriving from topological, fractal and relativistic spacetime models. Research activity has been in foundations of quantum computing and applied macroscopic quantum entanglement systems, and also in applications for both space-related and biomedical problems. Investigations include mathematical modeling and analysis of nonlinear and chaotic patterns, anomalies, and irregular behaviors. Applications of special interest include two interrelated areas:

> (a) predictive analysis of turbulence, chaos and system failure/recoverability in models relevant to both aerospace propulsion dynamics and biological/ecological systems
> (b) topological condensation models, high-temperature Bose-Einstein condensates and neutron soliton propagation for potential use in the design of energy generation systems applicable to space-based solar power, controlled fusion and other exploratory forms of remote and compact power production.

Activities also include being principal organizer of TETRAD Seminar Series (http://instinnovstudy.org/seminarseries.php) in quantum physics and biology and large-scale modeling, and the work of the Ecoaduna Foundation.

§ 2003 - Present: Chief Scientist (Co-Founder), TETRADYN Ltd. (TETRAD Group)

See project activity descriptions in sections above and http://tdyn.org (including http://tetradyn.com). Development of sensing, imaging, and recognition methodologies for (principally) closed-system and environmental health threat detection/abatement applications. Focus upon inverse and nonlinear models and algorithms including applications of quantum computing (QC) models using conventional systems and instruments with objectives of implementing QC in future versions. Analytical instrumentation included GC/MS, FTIR, XRF, AFM, Raman, HPLC, AA and radiation spectroscopy. Architecture design and programming of analytical functions (Matlab, Mathematica, Maple, LISP, Qi, C++).

R&D in intelligent control, sensing, imaging and actuator response, principally chem/bio/rad and human-machine interfaces: **CEBIT** (Chemical-Explosives-Biological Identification and Tracking), **Nomad Eyes** (distributed CEBIT-based situation awareness, early warning and response network) and **CUBIT** (Coordinated Unified Biothreat Intervention and Treatment). Other collaborative sensor work has involved nucleic acid amplification techniques (PCR) and immunoassay with optical waveguides.

Responsible for distributed technical and scientific team management, proposal/bid development, business plan components, project management, product evaluation (technical and market/customer acceptance). Experienced in setup and management of new lab/center environments, procurement, clinical trials planning and logistics, business planning including spin-outs and new ventures, new team formation, public presentations and communications.

§ 2001 - 2015: Visiting/Adjunct Professor, (various institutions, part-time: MSU; UCR; U-Pitt; UT; VU; VT; KPI)

Graduate & undergraduate teaching (maths, humanities, computer/information science, medical informatics); student advising & mentoring; curriculum & program development (applied biomedical science and informatics, mathematics, computer science, health information technologies). Collaboration-development with corporate, academic and public institutions.

§ 2000 - 2003: Group Manager and Research Lead, Intel Corporation (USA, Costa Rica, Russia)

Responsible for consortium-based research activity with regional (Costa Rica and Latin America) scientific institutions (CENAT, FUNDES, LANAMME) and also with Russia as part of corporate new business development. Research focused upon nanomaterials and microfluidic MEMS technologies. Managed two separate and distributed international teams. Helped establish nanotech lab in San Jose in conjunction with CENAT) for quantum dot and graphene investigations; key application projects were a MEMS-based mass-spec analyzer and a biosensor based upon carbon nanotube assemblies. Assisted as analyst/advisor for Intel Capital VC investment.

§ 1996 - 2001: CEO and Director of R&D (Co-Founder), Silicon Dominion Corporation, Richmond, VA

Directed development efforts of startup R&D company (with a twelve-person offshore tech team; Russia and Eastern Europe) producing products in two areas:

(a) Nanostructured materials and technologies – focus on controllable quantum dots, magneto-optic sensing, carbon nanotube fabrication and array structuring, and modeling tools for micro/nano-materials applications including EMF-based sensing and system diagnostics;

(b) Internet-based research and research-collaboration tools. Products included Open Stream Media and Open Net Tool Suite (medical and emergency-response oriented software and networks), and MODE (magneto-optics-based sensing and measurement). MEMS-based molecular sensing R&D led to platform of molecular-scale detectors.

§ 1993 - 1998: Assistant/Associate Professor, Physics and Biomedical Engineering (dual appointments), Virginia Commonwealth University (Medical College of Virginia), Richmond, VA

Founded and directed Molecular Engineering and Biocomputing Center (MEBC lab). Research focus on theory (quantum computing and algorithms) and applications of nonlinear models and complex systems (cellular automata, attractors) to biological signaling and nanosystems. Developed genetic-algorithm and neural-net models. Research in quantum solitonic (tensegriton) models, macroscopic quantum effects (biosolitons), nanostructured materials, and experimental work on intracellular submicron imaging using in vitro neural cell cultures. (See below for papers, courses taught, student masters/PhD/MD projects). Also implemented a pioneering internet-based telemedicine information resource and medical informatics network linking U.S. hospitals & companies with foreign institutions.

§ 1988 - 1993: Senior Scientist, Special Projects, SGS-THOMSON Microelectronics (now ST.com), Baltimore MD (Concurrent 1991-1992: Visiting Faculty, VA Tech & Radford Univ.)

Introduced use of AFM and STM for defect and fault analysis. Designed prototype development of real-time parallel processing and also a pattern recognition (neural net) processor chip for object recognition and microcontrol. One focal area was in addressing error tracking and correction within very large parallel systems used in satellite, rocket and missile systems. Core neural chip was later applied to pattern recognition. Led and served on team and task group for prototyping, training on new microprocessor and image processing devices. Established corporate-university joint research project for signal processing including research in brain hologram and quantum biology models. Concurrently worked on PhD studies and dissertation.

§ 1985 - 88: Senior Engineer / Project Manager, Martin Marietta Aerospace, Baltimore MD

Designed and implemented autonomous and guided robots and manipulators. Established artificial intelligence lab for autonomous robot R&D. Designed first motion and obstacle-avoidance controller for Navy deep-sea autonomous underwater robot, employing sonar and lidar. Served as liaison/consultant to partner companies and govt. agencies on sensor, data fusion,

recognition. Performed software R&D and management concentrating in artificial intelligence and neural networks. Research activities included application of quantum-theoretic models for macroscopic environments and large-scale MIMD parallelism.

§ 1983 - 85: Research Scientist, Artificial Intelligence Group, Battelle Labs, Columbus OH

Designed and implemented rule-based, neural-net and other nonlinear AI expert systems, simulations and development tools for medically-related fault-diagnostics, process control and qualitative physics. Developed set-theoretic based relational DBMS and architecture for data mining and knowledge extraction over sensor-actuator networks. Co-PI on project to develop artificial intelligence models for use in analysis of technology databases and system diagnostics data streams (fault control and monitoring of nuclear power and defense systems).

Selected Financial-Sector Projects (conducted as a consultant to special institutions)

- Mortgage-backed securities and MBS-related derivatives, trend-spotting and forecasting with neural network and fuzzy logic methods, Crestar Bank (later Sun Trust), 1992-93
- Interest rate modeling, Wheat First Securities (later First Union) 1993-94
- Multi-processing and parallel processing algorithm assessment and training, Federal Reserve Bank 1995-1997
- Evaluator of companies seeking VC-level investment - for Intel Capital (while @ Intel Corp.), IFC, EBRD (while in Russia) – focus on Latin American and Russian companies (2002-2005)
- Anomaly detection and tracking, financial fraud and forensic accounting, Washington, DC 2012-2013

***Selected* Basic/Applied Publications and Invited Presentations** (full-scope, multiple disciplines; chronological order)

- IVC: An Intelligent Vehicle Controller with Strategic Real-Time Replanning, Proc. of the IEEE 1987 Int'l Symposium on Intelligent Control, Philadelphia PA, January 1987
- SOLON: An Autonomous Vehicle Planner, Proc. of the JPL Workshop on Space Telerobotics, JPL, Pasadena CA,
- Multi-Dimensional Network Technologies: Adapting Autonomous Architectures for Space-Borne Applications, RAMCOR Technical Note 1988-4
- Transputer-Based Networks for Parallel Distributed Sensor Systems, UKIT-90, Southampton England, Mar. 1990
- Parallel Replicative Neural Networks for Cooperative Robot Systems, NATUG-90, Santa Clara CA, April 1990
- Adaptive Network Topologies and Symbolization, AAAI-90, Boston, 7/29/90
- (editor) Proc. of First Workshop on Integrating Neural and Symbolic Processes (workshop, AAAI-90, Boston, 7/90)
- Neural Networks Using Transputers, in Neural Networks and Parallel Processing: Sixth-Generation Computer Technology Series (ed. B. Soucek), John Wiley, NY, 1991
- Quantum Coherence and Molecular Computation, Neural Networks Summer School, Dubrovnik, 1991
- Prospects for mesoscopic quantum phenomena and their role in the evolution of learning mechanisms, NATO Adv. Res. Workshop on Coherent and Emergent Phenomena in Biomolecular Systems, Univ. of Ariz., Tucson AZ, January 1991 (also published in Nanobiology, Vol. 1, 1992)
- A 16-bit real-time neural network processor, SGS-Thomson Tech Note, 3/91
- The CSP Model, Quantum Physics and Implications for the Brain, Radford University, 5/91
- Endophysics and Pattern Recognition, Univ. of Texas at Arlington, 2/92
- Quantum Process, Information Theory and Parallelism, Institute of Nuclear Physics, Novosibirsk, Russia, 5/92
- Molecular and atomic computers as nano-scale recognizers, IJCN, Baltimore, MD, 7/92
- Quantum Processes and Dynamic Networks in Physical and Biological Systems (PhD Thesis), Union Institute, 11/93
- Quantum Dynamic Networks, Chaotic Solitons and Emergent Structures in Subcellular Processes: Possible Implications for Learning and Memory, in Toward A Scientific Basis for Consciousness, S. Hameroff (ed.), also presented at Third Appalachian Conference on Brain Behavioral Dynamics, Radford University, Sept. 1994
- IMEDNET : Information Gateways and Smart Databases for Telemedicine and Distance-Based Learning Using the Internet and the WWW, Internet Medicine, Chicago, Oct. 23-24, 1995
- Nanosystems and Self-Organization In Massively Parallel Competing Populations, VCU, 11/95
- Chaotic 3D and higher-dimensional Solitons, Rev Nuclear Physics C, 5/96
- CommonHealthNet as an Architecture for Practical Global Medicine, Global Telemedicine and Federal Technologies Conference, Williamsburg, VA, 7/96
- Over the Edge of Chaos: Rethinking the Relationship Between Chaos, Complexity, and Emergent Order; Implications for Novel Types of Computation, The Int'l Conference on Nonlinear Dynamics and Chaos, 12/96
- Multi-Unit Airborne Detection and Mapping of Land Mines Incorporating Magnetic and Non-Magnetic Sensors, Conf. on Detection of Land Mines, Edinburgh, UK, 7/98
- Quantum Self-Organization Theory with Applications to Hydrodynamics and the simultaneity of Local chaos and Global Particle-Like Berhavior, Acta Polytechnica Scandinavica, 91, Espoo, 1998
- Topological Process Dynamics and Applications to Biosystems, College of William and Mary, 10/98
- Stimulated Topological Condensation of 'Vapour Phase' Photons and Possible Implications for Space Power Technology, NASA, Houston, 10/98

- An Adaptive Magneto-Optic Thin-Film Based Architecture For Self-Structuring Sensing and Recognition Devices, Foresight Conference on Nanotechnology, Palo Alto,10/98
- Developing A Practical Wearable Telemedicine System for Emergency and Mobile Medicine, Global Medicine,11/98
- Coordinated Traffic Incident Management Using the I-Net Embedded Sensor Architecture, SPIE-98,Boston,12/98
- Structural Integrity Inspection and Monitoring By Magneto-optic Sensors, SPIE-98, Boston, MA, 12/98
- MediLink -- A SmartCard-Assisted Wearable Data Acquisition and Communication System for Emergency and Mobile Medicine, INABIS, Toronto, CA 12/98
- A Family of Microinstruments for Smart Materials, Energy Management, and Biomedicine in Space Missions, Nanotechnology Space Systems Conference, Houston, TX, 2/99
- Design of Magneto-Optic Wide-Area Arrays for Deep Space EMF Studies & Power System Control, IAA, Turin, 4/99
- How Topological Condensation of Photons Could Make Possible Energy Extraction in Deep Space, NASA Conf. of Breakthrough Propulsion, Cleveland, 6/99
- Pattern Recognition and Learning in Bistable CAM Networks, Int'l Joint Conf. on Neural Networks, Washington, 1999
- Topological Condensation and Conversion of 'Vapour Phase' Photons into Kinetic Energy, 2000
- How Quantum Events can play a role in Coherent Biomolecular Systems, QNSRBIO (Invited), Kiev, 3/01
- Saño y Salvo (Invited Article on public health and safety), San Jose Press, 3/02
- Innovación (Invited Article on youth creativity and innovation), San Jose Press, 7/02
- Chaotic Local Attractor Networks, Lebedev Institute, 1/03
- Topological Solitons in Non-Linear Models, Moscow Inst. of Physics and Technology, 2/03
- Tensegritons: A General model (preprint, 2003)
- rEvolution in Print and Internet through Nanotechnology and E-Materials (Invited) Frankfurt Book Messe, 10/03
- Quantum Networks,Structure and Relativity: Toward a New Mathematics integrating Quantum Mechanics, Complexity, Chaos and Relativity, Moscow, 8/04
- Mobile Early Warning, Intervention and Public Health Response to Nuclear Terrorist Actions, 3rd Int'l Conf. on Radiation Countermeasures, St. Petersburg, Russia, 10/04
- I^{3}BAT and Nomad Eyes - Countermethods of Sensing and Preventive Response, European Symposium on Counterterrorism Response, Berlin, Germany, 12/04
- Integrated Navigation-Control for Multi-Modal Oncology, NIH/NCI, Bethesda, MD, 2/05
- Applying Geospatial Representation and Forecasting Models for Improving Chem-Bio-Rad Defense in Battlefield and Counterterrorism Field Operations, Human System Interfaces (HSIS), Arlington, VA, 6/05
- Asymmetric Approaches to Anomaly Analysis in Medicine and Biodefense (preprint; talk given at Center for Biosecurity, UPMC, Baltimore, 7/05)
- Complementing Mutual Information Techniques in Deformable Registration Processing for Clinical Applications, UPCI, 8/05
- A Mutual Information Approach to Developing Reasonable-Likelihood Associations and Correlations between Asymmetric Events and Anomalies, CSIS, 10/05
- A Mechanism for Detecting Trigger Points and Irreversibility Thresholds in Shock and Trauma for Catastrophic Events, MMVR-DARPA, Long Beach, 1/06
- Flexible Polymer Film Based Sensor Networks for Invasive and Non-Invasive Medical Monitoring, Military Medicine and Virtual Reality (MMVR-DARPA), Long Beach, 1/06
- Integration of Biodefense with Public Health and Preventive Medicine (Invited Workshop), MMVR-DARPA,1/06
- Evolutionary Detection & Prevention of Emergent Nonlinear Processes (Invited), CBRNE Countermeas, Paris, 9/06
- Connecting the Dots to Locate & Intercept Terrorist Operations & Operatives (Invited), 2nd CMMC, WashDC, 10/06
- Topo-Cyto-Dynamics, ASMB, Baltimore, 2007
- Life-Saving Technologies Critical to Improving Speed and Scope of Response to Mass-Population Emergency Events and Pandemics, 17th World Conference on Disaster Management, Toronto, CA, 7/07
- Addressing Recognized Potential Gaps in Epidemiological First-Line Early Warning Methodologies (preprint, 2008)
- Changing Currents in Environmental Analysis, BIC Journal, 4/08
- Space, Light and the Problem of Stability and Anomaly within Highly Turbulent Nonlinear Systems (preprint, 2008)
- Rapid Deployment of On-Site Analysis and Response to Critical Chem-Bio Emergencies, Pittcon Courses (also four conference papers on CBRN trace-detection and forecasting),Chicago, IL, 3/09
- CUBIT - a protocol and methods to high-population-impact rapid-transmission biothreats (Invited), CDC, 7/09
- CRAIDO and MADIT – Mutation Anomaly Detection and Tracking, Race for Resilience, Washington, DC, 8/09
- Paradise Lost, Risk Management Regained, Patterns and Predictions, 10/09
- First Photon: Quantum Relativistic Topologies (preprint, 12/09)
- The Second Part of Physis (Tensegrities in Solitonic Networks), (Baden-Baden, 2010)
- Hybrid Anomaly Detection Methods Applied to Turbulence and Flow Control (2010)
- Prediction of Flow and Direction in Complex Systems by use of Inverse Relational Maps with Remarks on Applications to Image-Guided Processing Applications (2010)
- DTCS : System Emulating Complex Dynamical Behavior of Large Competing Populations, (Complex Systems 2011)

- Technologies to support, enhance and protect social networking freedoms during periods of social unrest and political disruption (ISCES Conference, Kuala Lampur, Malaysia, 6/11)
- Conservation of Curvature, Eigensets and Volume Separability (2011)
- Effective, Economical, Adaptive Countermeasures to Innovative & Increased Risks from CBR Disasters, ASA, 143, 12/11
- Quantum relativity, gravity and the spatial (pre-space-time) nature of matter, (*2011/2012)
- Dynamic solitonic networks as a foundation of matter and energy (*2011/2012)
- Emergent structure and process in the universe (space-time and matter as emergence from/through/by underlying quantum complex network processes) (*2011/2012)
- Quantum solitonic networks and the Standard Model (from QR principles to the emergence of particles) (*2011/2012)
- Inverse relations, cognition and the discovery of natural laws (*2011/2012)
- Topological and field-computational model for signaling and control in biological organisms (*2011/2012)
- The problem of non-locality in a process-based universe (*2011/2012)
- The soliton as constant - new approaches to representation and change in mathematics and physics (*2011/2012)
- Asymmetric folds in space and the concentration of discrete probability densities representable as coherent attributes of waves and particles (*2012/2013)
- Quantum Relativity – Process, Structure, Dynamics (*book; expected publication 2016)
- Compass Rose: Navigating the Non-Linear World (*book; expected release: 2016)
- Macroscopic applications of probability density models derived from “classical” quantum mechanics (*2012/2013)
- Identifying Redundancies, Knots, Loops and Dispositions (*2012/2013)
- “Self-surgery” Ricci flows in quantum physics as mechanisms for sustained particle-like tensegritons (*2012/2013)
- Design and Prototyping of Life Support and Agriculture for Extended Space Habitation and Travel (Invited Paper), 100 Year Starship Conference (DARPA-sponsored), Houston TX, 9/13
- Bioelectromagnetic field measurement and control using Bose-Einstein Condensate configurations (*2013)
- Mathematical representation of increasing Ψ (probability densities in region of space-time) as a linear consequence of folding and compressing of space (*2013/2014)
- Abductive Logics and Inverse Relational Maps within Entangled Systems (*2014)
- Penetrating the Hard, Invisible, Untouchable and Intractable – realistic parallel approaches in Quantum Computing (*2014)
- Solitonic curvature sets in n-spaces providing a framework for predicting socioecononomic and geopolitical events (*2014)
- New Valuation Principles for Venture-Cap and Private Equity - Matching Announcements of Emerging Technologies and Products Earlier with More Realistic and Accurate Prospects for Market Acceptance and Corporate Value (*2014)
- ANLINA-MUTTI – Assessment of Critical Problems that Quantum Computers and Human Ingenuity May Solve (*2014)
- PARDA - Rationale for a New Program of Investigating, Modeling and Predicting Hard-to-Observe and Deliberately-Concealed Sequences of Events (*2014)
- Quantum Computing, Viral Outbreaks and Needles in Haystacks (Dupont Summit, Dec. 2014)
- PALLAS and METI-NETI – A Class of Hybrid Algorithms for Optimizing Outcomes in High-Risk Dynamical Problems characterized by Variable Levels of Uncertainty among Key Parameters (*2015)
- Quantum Computing and Synthetic Intelligence Requires a Biologically Based Fractal-Recursive Architecture (*2015)
- A Fractal Recursive Computational Model for Quantum Computing (*2015)
- Designing and Implementing a QBrain – Quantum Computing Array in Two Phases - Hybrid Parallel Turing-Machine Processing and CQER Qubits (*2015)
- Exoplanet Suitability Exploration and Discovery – Applying the ASTRIC Model (100YSS, Oct. 2015)
- Black Hole Border Sheath Zones for Traversable Wormhole Space Travel (100YSS, Oct. 2015)
- Design, Construction and Maintenance On-The-Fly of Interstellar Spaceship Fleets (100YSS, Oct. 2015)
- Pod-Net Life in Deep Space - Distributed Network Space Vessels and Interstellar Travel (100YSS, Oct. 2015)
- Space Races and the Crises of First and Close Encounters (100YSS, Oct. 2015)
- TERANOD Fusion Applied to Propulsion for Exoplanetary Missions (100YSS, Oct. 2015)
- Spaceships To Planet Earth: Designing Systems for Space that Sustain Life on Earth (Dupont Summit, Dec. 2015)
- Digital Imaging and Virtual Reality Applied to Neurorestorative Therapy (NextMed, April, 2016)
- Virtual Reality and Tele-Med-Education Tools for Personal Health Monitoring: a Focus Application on Anti-Oxidants and Oxidative Stress (NextMed, April, 2016)
- MaskMan – Integrating VR with 360-degree 3D Real-World Action (NextMed, April, 2016)
- Stabilization, optimization and reorganization dynamics (*2016)
- Quantized transitions between turbulent states at different energy levels & different metrics (scales of observation) (*2016)
- Turbulence Transition Phases and Potential Values for Aircraft Design and Operation (*2016)
- Directed controllable hyper-turbulence as a countermeasure technology for neutralization of airborne threats (*2016)
- SELDON Prediction Engine (*2016)
- ExITE Exchange of International Technology Entrepreneurship program development and its first-phase implementations in Russia and Eurasia, 2014-2016 (*Dec. 2016)

- The changing face of the once-quiet bugs - ecological and climate-change impacts upon Zika, Ebola and other (*Dec. 2016)
- The Race and Space – Humanity at a Threshold in Energy, Environment, Health and Social Sanity (*Dec. 2016)

Additional publication, presentation and preprint information - available upon request.

Selected Recent Abstracts are below

Courses Taught at University (G=Graduate) Level

- Cellular Automata and Discrete Systems
- Chaos, Fractals, & Stability in Biology (G)
- College Algebra & College Mathematics
- College Physics (intro/intermediate)
- Complexity and Nonlinear Systems (G)
- Computational Biology (G)
- Contemporary Theoretical Physics (G)
- Critical and Analytical Thinking
- Cryptography and Cyberdefense
- Godel and Computability (G)
- Issues in Quantum Mechanics (G)
- LISP and PROLOG programming (G)
- MATLAB, Maple and Mathematica
- Medical Image Processing (G)
- Microcomputer & Multiproc Architectures for BME (G)
- Molecular Engineering and Imaging (G)
- Neural Networks & Pattern Recognition (G)
- Neurocomputing Architecture/Systems (G)
- OCCAM & C/C++ Parallel Processing (G)
- Philosophy of Physics (G)
- Quantum Measurement (G)
- Quantum Physics and Theory (G)
- Relativity (G)
- Research Methods & Statistics
- Scanning Probe (AFM) Microscopy (G)
- Signal Processing (G)
- Statistics and Thermodynamics (G)
- DSP, Transputer & Multiprocessor Architectures (G)

Student Projects (principally at graduate level or PhD candidacy level)

- Simulation of quantum-entangled cellular automata virtual machine
- Automatic chromosome aberration scoring using competitive neural networks
- Prototyping of multimedia relational biotech databases with Principal Component Analysis data mining
- Integration of cellular automata and neural networks with SPICE models of cellular chemical communications
- Neural network classification of QSAR on on mutagenic activity of nitroaromatic and heteroaromatic compounds
- Neural net modeling of Alzheimer's senile dementia and also pharmacological population kinetics
- Pharmakinetics employing neural networks and genetic algorithms applied to non-linear time series
- Deformable mage processing for topological feature extraction in cell membranes
- VRML and ISOVIEW 3D imaging and molecular modeling software
- Artificial life (cytoskeletal dynamics) simulation engine
- MediPAC and MediCard ("smart card") medical database interface prototype
- Pattern recognition and classification on MRI, CT, AFM and STM scan images
- Real-time tele-engineering with Nanoscope and AutoProbe LS scanning probe microscopes
- Modeling 2d and 3d soliton and PDE equations in MATLAB, Mathematica, and MacSyma
- In vitro imaging of neural and glial cells and AFM-detected cytoskeletal features
- Cellular automata modeling of cell membrane and cytoskeletal structures
- Magneto-optic scanning and measurement within in vitro cell cultures
- Magneto-optic nondestructive testing and confirmation of structural elements and secure documents
- Artificial intelligence applications in ETL and data warehousing for semiconductor fabrication and IC assembly/test
- Encrypted distributed digital signature system for use with smartphones and wearable internet devices
- Mutual information and deformable pattern registration for synchronizing MRI and CT
- Stochastic and quantum-chaotic modeling of entity-relationship object networks
- Simulated annealing and stochastic computational artifacts
- Biosolitons as a mechanism for molecular memory and signaling

Special Invited Lectureships and Appointments

1989 Edinburgh University and Durham University, Dept. of Computer Science
1990 University of Belgrade, Molecular Machines Research Center
1990 Neural Network Summer School, Dubrovnik
1991 Center for Brain Research and Information Sciences, (jointly) Radford University and Virginia Tech
1992, 1993 Budker Institute of Nuclear Physics, Novosibirsk
1994, 1995 Joint Institute of Nuclear Research, Dubna
1995, 2014 Bogolyubov Institute of Theoretical Physics, Kiev
1997 Eotvos Technical University, Budapest
1998-2004, 2016 Adjunct/Visiting Faculty, Moscow State University
2001, 2014 Kiev National University, Kiev
2001-2002 Adjunct Faculty, Centro Nacional de Alta Tecnologia, San Jose, Costa Rica
2005 Univ. of Pittsburgh Cancer Institute
2006-2007 Interim Director, Loudermilk Institute of Sustainability

2009 – 2011, Fellow, Center for Advanced Defense Studies, Washington, DC
2009-2011, Vanderbilt University Medical Center
2009-2012, Advisory consultant, CDC NBAS (National Biothreat Advisory Subcommittee)
2009 – present, Advisory Board, Society for Digital Information and Wireless Communications
2010 – present, Project Member, Principia BioCybernetica
2016 – Kazan Federal State University and Krasnodar Federal State University

Professional Memberships and Activities

AAAS	American Mathematical Society	Intl. Assoc. Math. Physics
American Institute of Physics	Computing Research Association	Intl. Soc. on Gen. Relativity & Grav.
American Physical Society	European Physical Society	World Future Society

Selected Corporate and Government Agency Consulting/Contract Work

BAE Systems	Exxon-Mobil	SAIC
Biosafe	GE	Schlumberger
Boeing	Global Infotek	Solutia (Monsanto)
BP	Intel Corp.	ST Microelectronics
DARPA	KPMG	UPCI (Univ. Pitt. Med. Ctr)
Deloitte (Japan)	KLA-Tencor	US Navy and US Marine Corps
EPA	Poulin-Hugin	Westinghouse

Further details on projects and duties, assignments, technical writing and proposal development are available upon request.

International Qualifications (*Listed in alphabetical order)*

(E) = employment (L) = residential living experience (M) = managing int'l staff (T) = teaching int'l students

Australia – L, T	Hungary – L, T	Pakistan – M, T
Belarus - M	**India** – L, M, T	**Russia** – E, L, M, T
China – T	Iran – L, T	Southeast Asia - T
Costa Rica – E, L, M, T	**Italy** – E, L, M, T	**Ukraine** – L, M, T
France – E, L, M	Japan – M, T	**United Kingdom** – E,L,M,T
Germany – E, L, M, T	Morocco – L, M, T	Yugoslavia(former) – L, M, T

Summary of EE/CIS (IT/IS) technical skills and experience levels, with examples

Tech Area (listed alphabetically by discipline and within by specialization)	Experience (1 (lower) – 5 (high) – hands on) (M1 – M5 – management)	Examples of prior or recent work in this area	Specific example knowledge areas, techniques, methods, skills
Architecture and design of applications and large enterprise-scale systems	4, M4	SOLON (AUV & UAV and Aegis weapon systems), work at Battelle, ADAM (ETL) at Intel, CommonHealthNet (telemedicine)	Use-Case, UML, Erwin, Corba, OOP, Rational Rose, XP (eXtreme Program), Agile, Crystal
Artificial intelligence, machine learning, pattern detection, classification, recognition. data mining, "Big Data" management	4, M5	SOLON, Horus, work at Comshare, Battelle, Martin-Marietta, VCU, Silicon Dominion, analytics within Nomad Eyes, CEBIT, GENOA, TIA, CASE, Tangram,Phoenix,CHAIN,PANDA	Classical AI (Rete networks, SOAR, rule-based, Prolog, Lisp), fuzzy logic, neural networks, statistical models
Electronic device design and testing (board/system level)	3, M2	ASW, AUV, Transputer chip/board, Intel microprocs, National instruments (DAQ)	Transputer family, also DSP chips, ARM cores
Information security and cyberwarfare	4, M4	part of work at/for Battelle (AFRL-Dayton, ARL), CIA, ARDA	Kyberos (KISS, Kerberos; not MIT protocol)
MEMS concepts, design, & software tools	4, M4	Cadence, CoVentor, Intel-proprietary, ST-proprietary	Nomad Eyes and CEBIT sensor processing
Microprocessor (chip) design	3, M2	Transputer, DSP, neural chip (ST-10/ARM based), Nomadics	Transputer family, also DSP chips, ARM cores
Multiprocessing and parallel processing	5, M5	Transputer chip and compiler design, apps to AUV and UAV, grad level teaching, part of core of Nomad Eyes, I^3BAT / I^3DIT work	MIMD and SIMD algorithms, multicore, RMS (DRMSO)
Programming languages	5, M4	this entered into one aspect or	C, C++, Java, Lisp, Prolog,

(incl. mathematical and modeling languages)		another of most R&D and applied work since 1975 – see examples of screenshots (separate document)	Forth, Fortran, OCCAM, Python, PHP, SAS, Maple, MATLAB, Mathematica, Macsyma

Selected Analytical Instrumentation Technology Skillsets (hands-on and project mgt)
Spectroscopy: PAS/RePAS (Photoacoustics), Immunoassay, Piezo-resistive microcantilevers (PRMC)
Microscopy: particularly SPM, AFM, MFM, SEM, TEM, Magneto-Optics
Analytical instrumentation: GC, GC/MS, Micro-GC, HPLC, FTIR, NMR, THz/MM
Biomedical instrumentation: NAAT (PCR), cell/tissue culturing, EEG, EKG, MRI
Languages: English (native); also Russian, German, Spanish, and limited in some others

Summary of Unique-Value Professional Qualifications and Experience

- Integrating analytical and synthetic thinking, open-minded, constructive critical thinking.
- Multi-tasking and empathic management; understand situations from the perspective of others.
- Skills in transfer and translation from theoretical, research topics into diversified application areas.
- Ability to develop "symbiotic" synergies between competing-interest individuals and groups, especially for new product or technology acceptance and use, including trade-off and competition.
- Extensive project management and team leadership incorporating remote, distance-based, distributed groups; skilled with critical schedule deadlines, unexpected changes and shifts.
- Experience in developing validation, testing and fault-tolerance for emerging new products, particularly where novel system integration is involved in design and manufacturing.

Main Relevant URLs

http://exo.tdyn.org (Exoplanetary Corporation and related ventures)

http://tdyn.org (The TETRAD Group of technology companies)

http://instinnovstudy.org (Institute for Innovative Study; focus: LEAPS Lab research; also published papers & presentations)

Personal Contact Data
Email: martinjd@instinnovstudy.org (Alternates: martinjoseph@tdyn.org or martinjd@tetradyn.com)
Skype: martindudziak
Mobile: (202) 415-7295 (also SMS, Viber, WhatsApp) Internet: (505) 926-1399
Post: 912 Sherman Ct, Ypsilanti, MI 48197 (USA)

Recommended Reading to Put Everything in Perspective: http://scaleofuniverse.com/

Some recommended books for nearly everyone: http://ecoaduna.instinnovstudy.org/reference-library/Recommended-Mandatory-READS.pdf

APPENDIX

Selected Recent Abstracts (M. Dudziak, principal author)

1. Turbulence Transition Phases and Potential Values for Aircraft Design and Operation

Research in the area of quantized transitions between turbulence states that are characterized by high degrees of non-linear stochastic dynamics now suggests that there may be techniques for improving both the predictability and control of such states, particularly the highly critical transitions that can create extreme vehicle stress and compromise vehicle safety and integrity. This is early-stage research based upon investigations into meta-stable structures within dynamic flows that create limits and bounds on transitions from one behavioral condition into another, thus providing a type of "quantization" between states that are characterized by high degrees of turbulent and chaotic internal dynamics. These investigations suggest the prospects of developing algorithms that can be applied to the design and the control systems (including both human and autonomous piloting systems) for a variety of aircraft and airborne machines. Analysis of probable interactions and consequences from interactions between an aircraft and various upcoming turbulence situations – both natural (e.g., weather formations) and man-made (e.g., intentional actions and countermeasures) – can potentially yield real-time solutions for altering an airborne vehicle's path, vehicle dynamics, or execution of effective airborne countermeasures, in order to preserve aircraft integrity and success of its mission. Improved understanding of how specific turbulence states can and cannot transform into different and more manageable states, or into less turbulent conditions, can be valuable in the design of diverse types of airborne vehicles and their control systems.

2. Design, Construction, Maintenance and Refabrication-in-Flight of Interstellar Spaceship Fleets

An interstellar spaceship design begins with a fundamentally different design for not simply a vessel, a machine, but a synthesized ecosystem, an organically-sustainable network that provides habitation, building materials, fuel, and full life support including comprehensive agriculture. This is not like a unitary, single-structure, static-design "spaceship" in the historical sense from both actual engineering and speculative design. There must be capability for fabrication of new materials and components that can be used for any part of a vessel in the fleet., Fail-safe operations must include redundancy and the capability to regenerate and re-use components in diverse ways. This constitutes a collective of reconfigurable units, a fleet rather than an individual vessel. One architectural component that can serve as a cellular building block is the nPod, a modular structure that can be reshaped and reassembled to meet needs for a number of geometries and functions. The nPod design offers the capability for many different configurations including tensegrity-based designs that may extend over many kilometers or even larger distances. Such node-arc designs may enable different types of energy generation and propulsion (e.g., stellar wind-surfing) or large expanses of biological growth, including crops for both food and organic construction materials. An nPod network, extending over even many cubic kilometers, may provide the geometry required for interstellar transport, power, habitation and community growth. This can include synthetic bioengineering for producing organic and hybrid-organic materials that can be utilized for expanding the structures as the mission progresses and as exoplanetary destinations are reached.

3. TERANOD Fusion Applied to Propulsion for Exoplanetary Missions

Nuclear fusion has been a dream of humanity for almost as long as alchemy. How to replicate the workings of the Sun and generate the energy that it produces in a similar matter. Several architectures have occupied the attention of theoretical and experimental physicists and engineers in the past half-century. While several are promising, none appear to be realistic for one of the important applications that will be needed in coming decades and centuries, namely, propulsion and other power sources for interstellar journeys, particularly those for which any reasonable reduction in the travel time is a critical goal, as with any manned travel to exoplanetary systems for possible colonization and inhabitation. Physical size constraints, coupled with the fundamental issue of maintaining an adequate fuel supply, render conventional approaches for fusion power generators to be unfeasible for space propulsion applications.

Since the mid-1990's a theory-intensive research effort has been conducted by a small international team of scientists. Deriving from work principally in 3D-solitonic structures for models of standard particle physics, and in quantum chaos theory, the TERANOD model for nuclear fusion is based upon the concept of sustained hydrogen fusion that is initiated in a gradual process and involving a substantially larger containment volume but one that is in a substantially smaller and lighter containment vessel. The model promises relatively compact fusion capabilities for applications such as in long-distance and long-duration space vehicles. The basic ignition system consists of multiple neutron soliton beams which are convergent within a confinement space that is maintained by the quasi-coherent dynamics of the reaction space and not by high-performance magnetics and massive material shielding.

The initial triggering events for generating neutron beam flow are governed by a fission reactor unit, itself comparatively compact in size. Containment for attaining fusion temperatures is based upon the reinforcement of solitonic properties in both the convergent neutron beams and the self-reinforcing quantum chaotic behavior within the reactor. Resupply of hydrogen isotope fuel in distant space missions will require collection through proximity to solar and near-stellar gas and plasma regions, and/or refinement of new hydrogen sources from select exoplanets. The TERANOD model is applicable to terrestrial-based fusion power plants which could by virtue of size and complexity reduction be sufficiently compact to be mobile, serving large vessels and floatation architectures for oceanic and airborne operations.

4. Exoplanet Suitability Exploration and Discovery – Applying the ASTRIC Model

Once several exoplanets have been deemed to be potential candidate worlds harboring life or being suitable for human colonization, there will be benefits for launching robotic probes that can effectively explore such worlds from within their solar system and even through atmospheric and surface probes such as has been accomplished with several of Earth's neighbor planets. The ASTRIC architecture, designed initially as a LEO-operating network of cooperating robot units for asteroid and related objects posing collision threats to Earth, offers a system design of adaptive and durable value for exoplanetary excursions of the type that will be necessary in order to select targets for large-scale human-engaged missions. This “EXO-ASTRIC” design assumes a sufficient means of propulsion to a target solar system, one that may offer multiple candidate planets. The architecture of the robotic units comprising the exploratory network is such that an AI-operative engineering system assembles final exploration units “on the fly” as an approach is made to a candidate planet or set of planets. From an internal warehouse of building-block components, final monitoring units are assembled and deployed. This design further enables the potential for one mission visiting a series of exoplanets, some of which may be within entirely different solar systems but all located along a logical “traveling salesman” pathway. The ultimate goal is for the exploratory mission to optimize time, energy and mission-intelligence functions in order to visit as many candidates as possible. There is certainly the capability within the design for including biological mission functions, if such be desirable within the scope of the explorations.

5. Pod-Net Life in Deep Space

Distributed Network Space Vessels for Interstellar Travel and Agriculture

Interstellar travel, at near-lightspeed propulsion and/or traversable wormhole navigation, requires an entirely new design thinking for building systems that provide life support for humans and equipment in totally alien environments. In-transit or at exoplanetary destinations, a starship vessel must be capable of diverse fabrication and manufacturing for the duration of the mission, including onsite colony base development. The “total support” requirement includes every aspect of life support, including agriculture in all forms and types. Carbon-based materials, ranging from hydrocarbons to nanofibers, nanowires, and graphene, may provide the basis for extension and varied construction during interstellar transit and on an exoplanet once reached. Biodynamic practices have for generations demonstrated a resilience and adaptability to environmental variations. These well-refined and stable methods of farming have produced high yields with minima of space, light, heat, water and other basic resources. Biodynamic agriculture can also aid to more sustainable and easily modified procedures for redirection and re-use of organic materials in the production of structures that may surely include expansion modules and vessel components of the traveling mission and the destination base. This amounts to a considering materials that are plant or animal material as part of the building blocks for the mission vessel(s) and base. Furthermore, for environmental sustainability, fault-tolerance and safety, components of the actual starship complex may include elements that are significantly distant, separated by even hundreds or thousands of kilometers, and some may be giant “greenhouse factories” run by robots in environments unsuitable for human life. Such a system environment may actually be designed and engineered on Earth for not only explicit prototyping for space missions, but as important agri-habitation environments on climate-challenged Earth itself.

6. Black Hole Border Sheath Zones for Traversable Wormhole Space Travel

Travel through hyperspatial channels connecting regions of spacetime separated from a Euclidean or Newtonian perspective by thousands or millions of light years – so-called wormhole traversal – has been the subject of intense theoretical investigation with speculation abounding with respect to the prospects of artificial construction for such channels. Reflection upon some of the known and expected properties of border regions, comparatively thin but stable and continuous sheath zones surrounding massive black holes such as have been observed at galactic centers and other regions of distant space, may point to a naturally-existing set of regions that could be employed by space-travel vessels without the innately destructive effects associated with black holes due to extreme gravitational forces and singularity effects. The so-called sheath may be an astrophysically “thin” envelope existing

at a discernable distance beyond the classic event-horizon of the black hole, such that there is a folding or warping of spacetime experienced by an object entering into this sheath region, navigating in a semi-passive manner (analogous to a marble rolling down a chute) but with potentially some degree of local control for velocity and direction within the constraints of the sheath region. While quite early-stage and subject to a need for astrophysical data, the prospects would have enormous value if such regions could be employed for even relatively short (1-100 light year) travel that would allow for human crews to be aboard and experience, biologically, only weeks or months during the transit.

7. Eigen-sets of curvature measure as a technique for defining separability among adjoining regions of n-dimensional spaces

We address from a novel perspective the problem of distinguishing regions within an n-dimensional space when those regions may be adjoining, overlapping, and (from one instance of observation to others) undergoing nonlinear and unpredictable transformations affecting their individual and collective geometries. We believe that there may be methods for more efficiently and accurately rendering these regions into identifiable entities, each of which will consistently maintain some characteristics, qualitatively analogous to an eigenfunction but drawing upon a set of flow or gradient measures related to changes in curvature taken cumulatively from multiple segments of the region surfaces, that will maintain stability and distinguishability from those sets of neighboring regions with which they could otherwise be confused. If our investigations can be extended and shown to have merit, then this may open up a new pathway within mathematics and computational analysis that can be of value in many areas of current research, such as within image processing, surface and subsurface sensing, financial and psychohistorical trend forecasting, meteorology, cosmology.

8. Macroscopic applications of probability density models derived from "classical" quantum mechanics

The commonplace bra-ket expression derived nearly a century ago by P. M. Dirac, $\langle\phi|\psi\rangle$, represents a probability amplitude for one state Ψ to collapse (reduce) into another, Φ. It is hypothesized that in modeling and predicting the behavior of large-scale populations of non-simple entities (e.g., the socioeconomic behavior of a region or global community), there is a threshold of complexity that dictates the limitations of conventional statistical methods and imposes a requirement to apply methods that are more similar to those of quantum physics. This complexity threshold is determined not only by numbers of elements but also by their possible relations with other elements and the variation of possible state-transitions into which any given elements or groupings of elements can enter. However, this "macro-field" or "super-field" imposes the requirement to address dynamic relations that will exist between regions (subsets of the global population of interest and study). Such relations will not be representable by simpler probability density formalisms but require a meta-structure that defines transformations upon any given state $\Psi>$. Note that there is no claim that Planck-scale quantized physical events are involved in affecting or modulating macroscopic behaviors being observed and modeled; this distinction is quite important.

The conjecture, if it may be so called, is that complexity driven by numbers of associations and a fundamental unpredictability of individual and cascade-like events, at any scale or density, demands the use of analytical methods that are fundamentally similar to the mathematics employed in quantum mechanics albeit with a number of significant changes driven by region-to-region relations within a given population space. The formalism of tensor products of the form $V \otimes W$ may be applicable, but only with modifications to accommodate the mult-scalar dynamics. It is thus suggested that a topological framework can be introduced into the analysis of very large population behaviors, whereby non-contiguous regions of a surface represent behavioral states (choices) of individuals and sub-groups within the population of interest. These can be shown to be associated, in a manner akin to the formalism of quantum entanglement, but with an understanding that no Planck-scale quantum entanglement is suggested. From this geometrical perspective arises the possibility of deriving certain common values that may be viewed as an extension of eigensystems – a type of eigen-transform that remains constant through a large variety of topological deformations. This leads to a possible construct that is not so distant from the familiar Schrödinger equation, $\hat{H}|\Psi_E\rangle = E|\Psi_E\rangle$, but now applied in a more general fashion to transformations of a field over time, treating the field as a composite of many elements and time as a process incorporating many operators. There exists the prospect of then "coming full circle," as it were, in terms of predictive modeling and behavior forecasting. By application of a novel eigensystem-like approach to what amounts to being a space of correlated and interdependent topological defects, using traditional eigendecomposition techniques such as are used in principal component analysis and similar statistical pattern classification paradigms, one may evolve a toolset that extends capability for useful prediction of events that appear to have extremely weak and indeterminate interconnectivity and dependence.

9. Asymmetric folds in space and the concentration of discrete probability densities representable as coherent attributes of waves and particles

The conventional model of the physical universe is one in which matter, manifesting as point-like entities exhibiting both wave-like and particle-like attributes, occupies locations in an otherwise nondescript and inherently empty space, with transitions in attributes giving rise to the notion of time as a measure of the duration of these attributes. A different interpretation presents a space that is primary and fundamental, active and in a timeless process of dynamic change which occurs within this space as a whole, giving rise to behaviors that are analogous to folds and creases within a three-dimensional volume and which change the quantum-scale probability densities for the presence of measurable and distinct energies. Following this line of abstract re-interpretation of that-which-is, we are led to a viewpoint whereby a particle, with mass of zero or any non-zero quantity, is not a substantial object located in an empty vacuum but an interaction and, as it were, an intersection, of many energetic probability densities that behave with varying levels of non-dissipative, solitonic behavior. A particle is then seen as a tensegrity structure that is constructed and that has endurance not from the assembly of permanent stable components but from coherent interaction of dynamic folds, creases, twists and tears in a singular and indivisible space.

10. Quantum Networks, Structure and Relativity

[excerpt] Our intuitive leap comes in the form of a suggestion that this problem of integrating quantum mechanics and general relativity is somehow not dissimilar and not unrelated from the problem of reconciling complexity and nonlinearity with stability, structure, and self-organization. There appear to be some common roots and perhaps some missing right language for bringing together quantum theory and relativity that also apply to the mystery of how coherent organisms like atoms, macromolecules, cells, and humans even exist in the first place, much less sustain themselves over lifespans. Further, we are inclined to suggest that this critical and aggressive problem in physics has implications that are intimated but not yet – before the solution can manifest itself – evident and accepted as definitive implications for biology and intelligence. Our suggestion is that some of the insights for the solution of the quantum relativity conundrum may come from precisely these seemingly disparate phenomena in complex and organic systems. This approach is quite unlike many of the speculative approaches that have emerged during the middle to late twentieth century for drawing together quantum theory, biology, and in particular the brain. We are not looking to extend merely an interesting analogy but are looking toward something that may best be called a radical general covariance principle wherein the coordinate system is not one of points in a grid but concepts and relations in an ontological space.

By way of one simple example, we can consider the simplest form of a solitary standing wave, a soliton of a type described by the elementary Sine-Gordon equation

$$\frac{\partial^2 v}{\partial x^2} - \frac{\partial^2 v}{\partial t^2} = \sin(v)$$

The complete mathematical vocabulary for these phenomena is in the traditional formalism for describing waves and rates of change; i.e. differentiation of a variable in terms of one or more others. This is straightforward PDE mathematics and grows out of the substrate of the calculus since the time of Leibniz and Newton. However this type of expression is not in a formalism made expressly for representing stability and structure first and foremost and rates of change second. The language of differentiation is a language for expressing change – in position, over time, or abstractly between one or more values in terms of one or more other values. This is important and essential to any physics that is also a *physis*. However, there are other qualities and their quantitative representations may lose something in the translation to a primarily differentiation-oriented mathematic – relationship, stability, morphology, coherence, dependence and interdependence are just some of those qualities. We are endeavoring to establish a set of tools that can show relationships and changes within and among waves such as that depicted by the S-G equation above. How else can we describe that form when it interacts with other entities that cause it to be reinforced or to dissipate, to maintain itself with some quantitative degree of certainty or confidence even, or to be transformed into a qualitatively distinctive other form? The direction in which this work moves is one of a process algebra built from primitives that include operators for topological and network-relational transformation.

Can such a new language, or a new description of the ur-phenomena at least – perhaps understanding the "particle" as a dynamic pre-space-time confluence of a network of events in a hypercrystalline vacuum, not as an object at all in its own right (leading to the implication that there are no objects or point-centered masses at all in the universe) – lead to a better theory. We keep coming back to that complex and multi-faceted question - why at one end of the dimensional scale everything seems both quantized and fuzzy, while at the other end there are these relativistic descriptions demonstrated left and right by experimental observation, and in between is a fuzzy region of

a different sort altogether, where quantum effects appear to be at work in macromolecular energy transport and biological information processing, yet having no apparent causal link with the “classical” quantum mechanics.

It is not only the qualitative side that is of interest, but the ways in which the qualitative differences between objects under transformation in a massive and complex population (particles, waves, molecules, people) can be quantitatively measured and classified. It seems to be a new type of number that is the goal, and with it a new type of geometry…

11. First Photon

[excerpt] We propose a model based upon the notion of a hypercrystalline vacuum that is fundamentally and simultaneously a perfect solid and a perfect space, through which as an enfolded or implicate potential order all possible paths exist and are followed. In this super-vacuum which is both Plenum and Void there emerges a pure spark of direction and individuation, the ‘A’ of creation, which can be understood as the First Photon. The big bang, no matter how one conceives of the process thereafter that first instant, occurs not in a superdense packed matter but in pure vacuum, so pure and total that there is no "room" for a particle to differentiate or individuate. However, the First Photon creates this possibility and thenceforth the vacuum cracks and splits in billions and trillions of paths, this process being otherwise measurable and describable as the Big Bang that initiates an inflationary, rapidly-expanding universe.

12. Topological BioDynamics – the role of boundaries and surfaces in cellular signaling and control

The rudimentary outline of a general theory of biological signaling and control is presented – topological biodynamics. The fundamental basis is an algebraic model for differentiation of field effects by cell membranes within eukaryotic cells and simpler processes within prokaryotic organisms. Viruses and prions are treated as special and significant cases where interactions with cellular organisms, particularly mammalian hosts, demonstrate the modulation of conventional metabolism in response to changes within intercellular topologies and sensed boundary conditions. Cytokine release and reception as a general case is examined in the context of coherent macroscopic field effects that have regulatory control over many instances of gene expression. The explicit goal of this paper is to generate further discussion and research along the lines of how cellular metabolism is a function of the continuous measurement of boundary conditions and extra-cellular processing. This topological approach is suggested to be fundamental in the primordial selection of protein structures for specific tasks and thus for the selection and refinement of information that is stored within genetic archives using nucleic acid chains as efficient (soliton driven and maintained) and fast-recall memory. A topological biodynamics representation model is suggested as the basis for embryonic and adult stem cell differentiation protocols as well as for regulation and deregulation of apoptosis and immunomodulation, with implications outlined for a large class of pathogenicity including both common and uncommon diseases of autoimmune, neurological, endocrine and oncological natures.

13. Potential for deriving anomaly indicators of critical mutation and reassortment affecting transmission of influenza A/H5N1 or A/H7N9 among mammalian hosts

Data streams produced in the course of RT-PCR diagnostics of influenza A virus subtypes, notably H1N1, H5N1, H1N2, H2N2, and H3N2 have been examined for microarray imaging intensity variations which can potentially be indicative of samples that have one or more substitutions from a list of known substitution sets of interest (the Herfst et al. and Imai et al. sets). Our working hypothesis is that such variations may be related either to the assay, amplification or hybridization procedures (type I anomaly) or to substitutions that have occurred within the native viral RNA samples and that are prior to and unrelated to the RT-PCR processing (type II anomaly). A mathematical model has been derived and is being further refined for discrimination between these two types. A sufficient positive sampling of type II anomalies in the course of clinical testing of a population subgroup could be an effective tool for the early indications of high-transmissibility viral strains of interest, particularly those with high lethality or severity for infected hosts. We conjecture that this model may be applicable to the discrimination of specific nucleic acid variations including substitutions that are associated with more facile transmissibility of certain types of influenza A virus, notably H5N1 and H7N9(2013).

14. Remarks on Quantum Computing Research

Quantum computing ("QC") systems that have begun to reach the stage of experimental implementation and testing range widely from adiabatic architectures to more "classical" quantum logic gate and quantum circuit designs, emergent and promising work in topological quantum computing models, and investigations based upon quantum chaos and turbulence including trapped ions and sustainable, repeatable cascade effects on similar

bases. Fundamental challenges exist in the areas of noise mitigation and stabilization of qubit networks (arrays) during the sustained period of times required to complete algorithm processing. The "QC problem" is critical for all current qubit and system-level designs and impacts the application of QC for real-world application tasks. My research beginning in quantum and relativity theory has been directed increasing at solving this “QC problem” of stabilization, sustainability and consistent reproducible measurement.

Stabilization and maintainenance of qubit-network coherence is a current impasse barrier that must be overcome in order for QC to evolve into systems that can provide reliable and stable performance for different classes of problems and for performance over time and in diverse physical operating environments. Propagation of coherent "quantum geometries/topologies" from one region of a closed system to another, or between QC systems, is another critical issue, one in which investigations turns to biology and also fluid dynamics as a high-possibility for illumination and inspiration for solutions.

In addition, many of the other scientific investigations in diverse fields - physics, astrophysics, molecular biology, epigenetics, nanostructured materials, to name a few - can arguably be said to certainly benefit from (if not require) QC in order to progress from "present early/speculative theory stages" to mature theory, practical experimental validation, and useful applications. This is arguably the case also for certain critical optimization, search and decision problems of international security, public health, environmental management and crisis response, space exploration, and also novel energy generation and power technologies.

Current attention is strongly directed at defining physical and algorithmic methods that can employ an "inverse" model of how noise and decoherence is used. This moves away from classical "Turing computing machine" concepts and closer to biology, and specifically the coherent propagation of information in both neuro-motor communications and the immune system. "Noise" - the disrupter of QC - may actually be translatable into cybernetic value for control, modulation, and stabilization, removing the need for complex and unwieldy error-correction qubit arrays and opening the gateway to very large scale interactions among independent qubit entanglement sets. The area of investigation known as CQER is of particular interest for not only QC per se but also the implications for quantum relativity and gravity as well as the implications and derivations of the same for both the Standard Model and Cosmology. Recent work also includes a fractal recursive computational model and its expectations for physical implementation using cellular-type field arrays that incorporate BEC (Bose-Einstein Condensate) properties.