ABSTRACTS and DOIs

(1) **Separable-expansion method for potential scattering and the off-shell T matrix**

Author(s): T. K. Lim and Judith Giannini

Department of Physics and Atmospheric Science, Drexel University, Philadelphia, PA 19104

Abstract: The closed-form, separable-expansion expression of Belyaev, Wrzecionko, and Irgaziev for the two-body T matrix is studied numerically for the case of a Yukawa potential. The method shows good convergence for the elastic scattering amplitude at intermediate energies, yielding results almost identical to Glauber's eikonal method.

Published in: Phys. Rev. (A 18, 1978), **Page(s)**: 517-520.

Date of Publication: 1 August 1978.

ISSN Information: DOI: https://doi.org/10.1103/PhysRevA.18.517

Publisher: ©1978 American Physical Society

(4) **Extremely low frequency quasi-static propagation measurements from a calibrated electric field source in the ocean**

Author(s): J. Giannini and D. Thayer

Applied Physics Laboratory, Johns Hopkins University, Laurel, MD, USA

Abstract: Experimental data are presented that verify a theoretical model for subsurface-to-subsurface quasi-static propagation from a horizontal electric dipole in a semi-infinite conducting half-space. The data were taken in an ocean environment in a frequency range from 1 to 10 Hz. Horizontal source/sensor separations from 180 to 450 m and depths from 46 to 100 m were used. Comparisons are made between the data and model predictions, relative to range dependence and magnetic field strength. The model predicted magnetic fields were found to agree with the experimentally measured fields approximately within experimental uncertainty.

Published in: IEEE Transactions on Antennas and Propagation (Volume: 30, Issue: 5, Sep 1982) **Page(s):** 825 – 831.

Date of Publication: Sep. 1982;

06 January 2003, http://ieeexplore.ieee.org/Xplorehelp/Help_Pubdates.html

ISSN Information: 10.1109/TAP.1982.1142909

Publisher: IEEE

(7) **Magnetic Anomalies from Conductivity Perturbations in a Conducting Fluid in an External Electromagnetic Field**

Author(s): Judith A. Giannini, J. Steven Hansen and Lynn W. Hart

Applied Physics Laboratory, The Johns Hopkins University, Laurel, MD 20707;

Carl Greifinger and Phyllis S. Greifinger R&D Associates, Marina Del Rey, CA 90291

Abstract: Magnetic-field perturbations associated with temporal conductivity anomalies in a conducting fluid in an external electromagnetic field have been measured. The measurements utilized a two-layer fluid, the bottom layer of which was conducting saltwater and the top layer of which was fresh water. A conductivity anomaly was created by causing a Mode 2 solitary wave to propagate along the saltwater-freshwater interface, and temporal changes in the magnetic field of a fixed electromagnetic source were measured. The data were compared with theory, developed here, and were found to be both qualitatively and quantitatively in agreement. The average deviation between the theoretical calculations and the experimental data was less than 6 percent.

Published in: IEEE Transactions on Geoscience and Remote Sensing (Volume: GE-23, Issue: 4, July 1985), **Page(s):** 574 – 580.

Date of Publication: July 1985;

29 January 2007, http://ieeexplore.ieee.org/Xplorehelp/Help_Pubdates.html

ISSN Information: DOI: 10.1109/TGRS.1985.289450

Publisher: IEEE

(9) **Variability Of The Diffuse Attenuation Coefficient In Waters Off The Us East Coast**

Author(s) : Judith Giannini

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Abstract: The seasonal variability of ocean color is examined using Coastal Zone Color Scanner (CZCS) data. The CZCS, on the National Aeronautics and Space Administration's NIMBUS-7 satellite, was in operation between late 1978 and mid-1985. It provided direct measurement of the upwelled radiance at wavelengths, in the visible regime, from which the diffuse attentuation coefficient, K, at 490 nm, K(490), was derived. Thirteen scenes are chosen from the mid-Atlantic Bight region off the east coast of the United States (approximately 30°N and 70°W) from 1979 to 1982, showing the seasonal variability in the ocean color on scales of approximately 30 000 km². The distributions show a shift in the peak K value and a change in their width as functions of season.

Conference Presentation: Geoscience and Remote Sensing Symposium, October 1988.

Published in: IGARSS '88. Remote Sensing: Moving Toward the 21st Century., International, Volume: 3

ISSN Information: DOI: 10.1109/IGARSS.1988.569477

Publisher: IEEE

(10) **The role of the second Painlevé transcendent in nonlinear optics**

Author(s) : J.A. Giannini.

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R.I. Joseph.

Department of Electrical and Computer Engineering, The Johns Hopkins University, Baltimore, MD 21218, USA

Abstract: A transformation of the complex amplitude of the propagating electric field in an optical fiber shows a family of exact nonstationary solutions to the nonlinear Schrödinger equation. These solutions take the form of the second Painlevé transcendent. In the case of normal group velocity dispersion (dark solitons), bounded solutions exist only over a finite range of the ratio of the nonlinearity to dispersion. .

Published in: Physics Letters A, (Volume 141, Issue 8-9, 1989), **Page(s):** 417-419.

Date of Publication: November 1989.

ISSN Information: DOI: 10.1016/0375-9601(89)90860-8

(11) **The propagation of bright and dark solitons in lossy optical fibers**

Author(s) : J.A. Giannini Applied Physics Laboratory, Johns Hopkins Univ., Laurel, MD, USA;

R.I. Joseph Johns Hopkins University, Baltimore, MD, USA.

Abstract: An analytic perturbation solution to the nonlinear Schrodinger equation with loss Gamma for both normal and anomalous dispersion is developed. Explicit results are obtained through second order in the perturbation Gamma . The results show that the dark pulse spreads less rapidly than the bright one and that total spreading as well as the difference in spreading rate for the two types of pulses decreases with loss. Comparisons are made with a zeroth-order perturbation theory and with numerical simulations, which are found to bracket the second-order results.

Published in: IEEE Journal of Quantum Electronics (Volume: 26, Issue: 12, Dec 1990), **Page(s):** 2109 - 2114

Date of Publication: Dec. 1990;

06 August 2002, http://ieeexplore.ieee.org/Xplorehelp/Help_Pubdates.html

ISSN Information: DOI: 10.1109/3.64346

Publisher: IEEE

(13) **The 4-meter lunar engineering telescope**

Author(s) : Keith Peacock, Judith Giannini, Charles C. Kilgus

The Johns Hopkins University, Applied Physics Laboratory, Laurel, MD, USA ;

Pierre Y. Bely ; B. Scott May ; Shannon A. Cooper ; Gerard H. Schlimm ; Charles Sounder ; Karen A. Ormond ; Eric A. Cheek

Abstract: The 16-meter diffraction limited lunar telescope incorporates a primary mirror with 312 one-meter segments; 3 nanometer active optics surface control with laser metrology and hexapod positioners; a space frame structure with one-millimeter stability; and a hexapod mount for pointing. The design data needed to limit risk in this development can be obtained by building a smaller engineering telescope on the moon with all of the features of the 16-meter design. This paper presents a 4.33-meter engineering telescope concept developed by the Summer 1990 Student Program of the NASA/JHU Space Grant Consortium Lunar Telescope Project. The primary mirror, made up of 18 one-meter hexagonal segments, is sized to provide interesting science as well as engineering data. The optics are configured as a Ritchey-Chretien with a coude relay to the focal plane beneath the surface. The optical path is continuously monitored with 3-nanometer precision interferometrically. An active optics processor and piezoelectric actuators operate to maintain the end-to-end optical configuration established by wave front sensing using a guide star. The mirror segments, consisting of a one-centimeter thick faceplate on 30-cm deep ribs, maintain the surface figure to a few nanometers under lunar gravity and thermal environment.

Published in: Proceedings of SPIE, February 1991.

ISSN Information: DOI: 10.1117/12.46721

Publisher: SPIE, The International Society for Optical Engineering.

(15) **Propagation in cylindrically symmetric two-dimensional nonlinear media**

Author(s) : J.A. Giannini.

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R.I. Joseph

Department of Electrical and Computer Engineering, The Johns Hopkins University, Baltimore, MD 21218, USA

Abstract: We present a transformation that reduces the (2+1)-dimensional nonlinear Schrödinger equation to a second-order ordinary differential equation with cylindrical symmetry. The equation has a family of solutions, valid for both normal and anomalous dispersion, that is an oscillating and exponentially decaying function of the radial coordinate. The solution takes the appearance of a bright central spot surrounded by a dark ring whose radius increases with propagation distance. A simple algebraic relationship between the radius and the propagation distance is given.

Published in: Physics Letters A, (Volume 160, Issue 4, Nov. 1991), **Page(s):** 363-366

ISSN Information: DOI: 10.1016/0375-9601(91)90666-V

(16) **The Second Painleve Transcendent and Nonlinear Optical Propagation**

Author(s) : Judith A. Giannini, Applied Physics Laboratory/ Johns Hopkins University

Abstract: A new transformation for the complex amplitude of propagating electric fields in optical materials shows a family of exact non-stationary solutions to the 1+1 and 1+2 dimensional nonlinear Schrodinger equations. These solutions take the form of a second Painleve transcendent. The propagation of electric fields in materials, such as optical fibers, is described in terms of the nonlinear Schrodinger equation where the nonlinear term is proportional to the intensity of the field. The solutions given here for the 1+1 dimensional equation propagate in the dispersive medium with no change in their shape or amplitude but with a curved path. In addition, the Painleve solution is extended to the 1+2 dimensional equation, giving a new two-dimensional cosine tapered structure that propagates without changing shape or amplitude. Part A of this paper develops the one-dimensional propagation in time. This part is a reformulation, with additional results, of the work previously published (J.A. Giannini, R.I. Joseph, "The Role of the Second Painleve Transcendent in Nonlinear Optics," Phys. Lett. A, 141, No. 8-9, (1989) 417). Part B of this paper extends the results of part A to two dimensional propagation in time. Both parts A and B represent work published in a Doctoral dissertation (J.A. Giannini, "The Propagation of Bright and Dark, Spatial and Temporal Solitons in Nonlinear Optical Materials," Doctoral Dissertation, Johns Hopkins University, (1991)).

Presented at: APL Symposium on Research and Development, Johns Hopkins University/Applied Physics Laboratory, Laurel, MD, November 1991

Published in: ResearchGate (2017) 8 pages.

(21) **Space-qualified fiber optic link for radar altimeter applications**

Author(s) : Joseph J. Suter · Johns Hopkins University/Applied Physics Lab, Laurel, MD, USA

Jay Poret US Army Armament Research, Development and Engineering Center ;

Moshe Rosen ;

Judith Giannini, Vipul Bhatnagar ; Charles C. Kilgus

Johns Hopkins University/Applied Physics Lab, Laurel, MD, USA

Abstract: This paper reports on the system design of an rf-modulated optical link for spaceborne radar altimeter applications and presents results of rf carrier phase noise and phase stability measurements. Our study involved the transmission of rf-modulated optical signals at 834 nm wavelengths using Bias-T and Mach-Zehnder modulators. The rf/microwave signals' phase coherence, modulation levels, and insertion loss are reported. Phase noise measurements revealed a noise floor of at least -118 dBc/Hz at frequencies greater than 100 Hz from a 5-MHz carrier with direct modulation. The phase noise was degraded by about 10 dBc/Hz for external modulation techniques. The rf insertion losses appear smallest for the Bias-T intensity modulators (approximately 30 dB at an 834 nm optical carrier with 5 MHz modulation). The results of modulation experiments with 320 MHz radar altimeter chirps are also presented with an emphasis on coherence, stability, and rise and fall time. The linear FM chirp signal ramps down at a rate of -3.125 MHz/microsecond(s) (+/- 0.5%) and is flat to within +/- 1 dB. Measurements show that this

type of FM chirp modulated on optical carriers at 834 nm meets radar altimeter system requirements.

Published in: Proceedings of SPIE, September 1993.

ISSN Information: DOI: 10.1117/12.156587

Publisher: SPIE, The International Society for Optical Engineering.

(25) **Quantitative size measurement of features viewed through a video endoscope**

Author(s): Vipul Bhatnagar Johns Hopkins University/Applied Physics Lab, Laurel, MD, USA

Jay Poret - US Army Armament Research, Development and Engineering Center ;

Joseph J. Suter, Judith Giannini

Johns Hopkins University/Applied Physics Lab, Laurel, MD, USA

Abstract: Quantitative size measurements of gastrointestinal tract lesions (i.e., ulcers and polyps) viewed during endoscopy are helpful in assessing the rate of healing or growth. We report a novel technique for quantitatively measuring the two-dimensional size of a feature viewed remotely via a video imager. Our instrument's small size makes it a suitable candidate for use in endoscopes. Computing the size of a feature displayed on a two-dimensional video monitor necessitates measuring the distance between the imager and the surface under observation because an undistorted video image preserves the angular content of a scene. We have developed a prototype ranging system that exploits the tendency of light emerging from the tip of an optical fiber to diverge. Our device uses two fibers with different divergence characteristics. The separation between the imaging sensor and the viewed surface is determined by inspecting the relative sizes of the spots cast by each of the fibers. Our device, which measures distances between 2 and 8 cm, is sufficiently small to be accommodated in an endoscope's accessory channel.

Published in: Proceedings of SPIE, July 1994.

ISSN Information: DOI: 10.1117/12.180712

Publisher: SPIE, The International Society for Optical Engineering

(32) **A fuzzy logic technique for correcting climatological ionospheric models**

Author(s) : J.A. Giannini and C.C. Kilgus

Applied Research. Lab., Pennsylvania State Univ., University Park, PA, USA

Abstract: This paper reports on a fuzzy logic correction technique for the IRI90 climatological ionospheric model that uses a sparse set of GPS total electron content (TEC) measurements to provide a significant model correction over the entire sub-solar equatorial bulge. Crisp inputs, represented by a sparse set of GPS measurements of ionospheric TEC, are ingested into the fuzzy correction model which is composed of a set of fuzzy membership functions and a knowledge base (fuzzy rules). The fuzzy logic estimation is an iterative procedure that begins with the uncorrected model as the zero order prediction of the shape of the subsolar equatorial bulge. The measured data (inputs) are fuzzified to account for errors

in the GPS measurements of TEC, and then are mapped onto fuzzy input-membership functions. The knowledge base is then accessed, firing the appropriate rules, to produce a fuzzy output estimate of the correction. This fuzzy estimate is then defuzzified to provide a crisp output correction that modifies the shape of the zero order prediction bulge to better fit the GPS data and to produce a first order prediction. The procedure is repeated until termination criteria are satisfied. The goal of the process is to accurately reproduce the characteristic signature of the ionospheric TEC along a satellite subtrack across the sub-solar equatorial bulge. The fuzzy logic model can make large scale alterations to the model prediction without requiring an extensive measurement data set and without inducing spikes in the local vicinity of the ingested data points. In particular, the IRI90 climatological model estimates of the ionospheric TEC were adjusted using two concurrent TEC measurements at locations approximately 800 km apart along the satellite ground track. For this first test, two simulated GPS measurements were derived from TOPEX dual-frequency TEC data. The results were compared with the TOPEX TEC measurements for four ground tracks in the Pacific across the subsolar equatorial bulge. Initial results showed a model improvement to within -0.32 TECU averaged over four entire passes ($\pm$66 deg/ latitude) when compared with the TOPEX "ground truth" measured TEC along track profiles. (1 TECU equals 10^{16}/ electrons/m^2.) The mean error over the equatorial portion of the passes ($\pm$20 deg latitude) was -4.65 TECU. The fuzzy correction model was run for 18 iterations, approximately full convergence. The averaging over sunlit passes provides an upper bound on the error since the spatial and temporal sampling allowed by the equatorial application include night time passes with low TEC. The residual error is dominated by the failure to match the structure of the TEC peaks north and south of the geomagnetic equator. Incorporating measured global averaged ionospheric geomagnetic index and a local solar zenith angle as inputs to the fuzzy logic may allow this error to be reduced. Fine tuning of the fuzzy logic model rules and full development of the multi-GPS station ingestion scheme can now proceed given that this first test shows that potentially the fuzzy logic correction is able to produce a correction that could satisfy the equatorial basin-scale measurement needs for GFO.

Published in: IEEE Transactions on Geoscience and Remote Sensing (Volume: 35, Issue: 2, Mar 1997), **Page(s):** 470 – 474.

Date of Publication: Mar 1997;

06 August 2002 http://ieeexplore.ieee.org/Xplorehelp/Help_Pubdates.html

ISSN Information: DOI: 10.1109/36.563287

Publisher: IEEE

(33) **A Java-based information system for wayside sensing and control**

Author(s) : L.F. Myers ; M. Lovette ;

C.C. Kilgus ; J. Giannini, D.C. Swanson,

Pennsylvania State Uinversity, State College, PA, USA

K. Reichard ; M. Mahon ; D. Mast

Abstract: The advent of Java-based information systems is causing a new network system structure to replace the custom designed client/server architecture traditionally used at

ARL/PSU for wayside sensing and control. Java applets provide the man-machine interface allowing access and control of the wayside system from multiple locations over a dedicated intranet or dial-up modems. The only user software required is a .....

Presented at: ASME/IEEE Joint Railroad Conference, Philadelphia, PA, April, 1998.

Published in : Proceedings of the 1998 ASME/IEEE Joint Railroad Conference.

Date of Publication: 1998.

(36) **The Fractal Rings And Composite Elementary Particles (FRACEP): A Picture of Composite Standard Model Fundamental Particles**

Author(s) : J.A. Giannini, Retired

Abstract: The object of this work was to study the feasibility of identifying a minimum set of fundamental particles that could be used to build up composite fermions and bosons that exhibit the same properties and behavior as the Standard Model (SM) fundamental particles. The spontaneous decay of most of the SM fermions suggests the possibility that they are composite in nature. The results of this arithmetically-based conceptual model identify a minimum set of only two fundamental particles (with equal and opposite mass) that combine in fractal-like configurations to form Intermediate Building Blocks (IBB). The IBBs then combine to form all of the SM fundamental particles and their anti-counterparts. These composite (bright universe) particles agree with the SM particles in mass, spin, electric charge, decay products and maximum classical radius (indicated by the scattering cross-section). Further, FRACEP identifies an equal set of dark universe particles, based primarily on its negative fundamental particle, which could represent the dark matter and energy understood to be the cause of the expansion of our (bright) universe.

Presented at : APS - Division of Particles and Fields Conference - Bulletin of the American Physical Society Vol. 61, No. 6, Session T1.031, Salt Lake City, UT, April 2016.

Published in: ResearchGate (2017) 19 pages.

(39) **Feasibility of Constructing a Unified Positive and Negative Mass Potential**

Author(s) : J.A. Giannini, Retired

Abstract: There is growing enthusiasm for the position that no single particle solves the puzzle of dark matter in the cosmos, a shift in perspective to include alternate ideas may offer part of the answer. Here, we advocate the (less than conventional, but not totally new) idea of negative mass as one possible contributor to the solution. We address the subject by empirically constructing a unified potential valid from the macro-gravity scales through the quantum scales that is non-symmetric between positive mass and negative mass particles. We discuss the similarities and differences between well-known potentials for traditional all-positive-mass particles, and, address the possibility that the Newtonian potential could be a first-order approximation to a sine function. Our fully unified potential (V_U) agrees with current data-consistent potentials from the largest macro scales down to quantum scales. Unlike Newton's potential which is only a function of mass, V_U is a function of mass, and the square-root of mass which impacts the negative mass behavior. The positive mass characterization is discussed here. In the macro-scale's far field, V_U has the usual $1/r$ decay. However, it also shows an oscillating transition between quantum-scales

and macro-scales where the Casimir effect is seen. The super-massive scales also show this oscillating quantum-like behavior in the near-field region.

Published in: International J. Mod. Theor. Phys., 8(1) (2019) 1-16.

ISSN Information: 2169-7425

Date of Publication: 3 May 2019.

(40) **Dual-Time Concept and Mythology Illuminate Intersection of Science and Religion**

Author(s) : J.A. Giannini, Retired

Abstract: Ancient records have numerous examples of concurrent, but different, accounts of time passage for the same events. The ambiguity leads to unreliable dating and diminished credibility in the factual nature of the events. As a result, ancient stories, particularly those with religious ties, are often designated as mythology with no scientific credibility. We show that viewing these stories with a dual-time perspective (linear for the human point-of-view and non-linear for the divine point-of-view) can relieve some of the ambiguity, and demonstrate factual consistency and credibility. As an example, we use the Genesis creation account – showing likely valid fact-based roots. The human perspective is a 24-hour Day, but the scientific record perspective is non-linear. Comparing creation myths and using Kinematic relativity, we present a mathematically-based BCE calibration for the Days, demonstrating that science and Genesis can be seen as totally consistent – differing only in the method of expressing their dates.

Published in: International J. Mod. Social Sciences, 8(1) (2019) 42-62.

ISSN Information: 2169-9917

Date of Publication: 10 May 2019.

42) **Fractal Composite Quarks and Leptons with Positive and Negative Mass Components**

Author(s) : J.A. Giannini, Retired

Abstract: The object of this work was to study the feasibility of identifying a minimum set of fundamental particles that could be used to build up composite versions of the Standard Model quarks, leptons and bosons that exhibit the same properties and behavior as the observations. The result is a fractal-based heuristic model that has only two fundamental particles (with equal and opposite mass).The fractal-like configurations of the multi-tiered substructure for the quarks and leptons demonstrated a dual universe – one based on mostly positive mass (the universe we see) and the other based on mostly negative mass (potentially a contributor to the cosmic dark matter universe we see evidence of without direct observation).

Published in: International J. Mod. Theor. Phys., 8(1) (2019) 41-63.

ISSN Information: 2169-7425

Date of Publication: 16 September 2019.