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Basis of Ionospheric Modification by High-Frequency Waves JUN 2007 21 pages

Authors: [S. P. Kuo](#); POLYTECHNIC UNIV BROOKLYN NY DEPT OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Full Text

The requirements of achieving ionospheric modification by ground-transmitted HF heating waves are discussed. The directly relevant processes including linear mode conversion and parametric instabilities are explained physically. The nonlinear & Schrodinger equation for Langmuir waves is reviewed and the initial conditions of two types of nonlinear solutions are discussed; from which the criterion for Langmuir soliton generation is pointed out.

Creation of Visible Artificial Optical Emissions in the Aurora by High- Power Radio Waves 03 FEB 2005 5 pages

Authors: [Todd R. Pedersen](#); [Elizabeth A. Gerken](#); AIR FORCE RESEARCH LAB HANSCOM AFB MA SPACE VEHICLES DIRECTORATE

Full Text

Generation of artificial light in the sky by means of high-power radio waves interacting with the ionospheric plasma has been envisaged since the early days of radio exploration of the upper atmosphere, with proposed applications ranging from regional night-time street lighting to atmospheric measurements. Weak optical emissions have been produced for decades in such ionospheric "heating" experiments, where they serve as key indicators of electron acceleration, thermal heating, and other ...

Study of Relativistic Electron Beam Propagation in the Atmosphere- Ionosphere- Magnetosphere 12 DEC 2001 66 pages

Authors: [Brian E. Gilchrist](#); [George Khazanov](#); [Linda Krause](#); [Torsten Neubert](#); MICHIGAN UNIV ANN ARBOR

Full Text

Models for propagation physics and associated ionospheric/atmospheric modification have been developed for the space-based injection of relativistic (E(-) 1-100 MeV) electron beams. Initial evaluations of beam propagation effects in the ionosphere, magnetosphere, and atmosphere have been conducted. The overall goal of this work was to develop computational tools and use them to better assess relativistic beam launch, propagation, and interaction with the space environment and atmosphere. Computational tools developed and ...

Studies of Plasma Instability Processes Excited by Ground Based High Power HF ("Heating") Facilities APR 2001 48 pages

Authors: [Aleksander V. Gurevich](#); LEBEDEV PHYSICS INST MOSCOW (RUSSIA)

Full Text

This report results from a contract tasking P. N. Lebedev Physical Institute as follows: The contractor will investigate how high power HF radio waves interact with collisional plasmas, such as the earth's ionosphere. Specifically, the contractor will predict and measure the formation of field aligned small scale striations; and energization of electrons along with their relationship to excited optical emissions. AFRL/AFOSR & AFRL/VS workers (Dr Carlson and coworkers) will provide ...

Studies of Plasma Instability Process Excited by Ground Based High Power HF ("Heating") Facilities 03 MAR 2000 13 pages

Authors: [Aleksander Gurevich](#); LEBEDEV PHYSICS INST MOSCOW (RUSSIA)

Full Text

This report results from a contract tasking P. N. Lebedev Physical Institute as follows: The contractor will investigate electron acceleration mechanisms. He will quantitatively compare his theoretical calculations to existing data from HF heating facilities at Arecibo, Puerto Rico, and, if possible, from SURA, near Nizhny Novgorod, Russia.

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- [Electromagnetic Diagnostics of Atmospheric Plasmas](#) MAR 2000 47 pages
 Authors: [Frank T. Djuth](#); [John H. Elder](#); [GEOSPACE RESEARCH INC EL SEGUNDO CA](#)
 This research program addresses fundamental issues related to the interaction of a high-power, high-frequency (3 - 10 MHz) radio wave with the ionosphere. Data acquired at the High-Power Auroral Stimulation (HIPAS) observatory in Fairbanks, Alaska was used to study the formation of artificial periodic inhomogeneities (API) in the lower and upper atmosphere. Quite remarkably, the API echoes are observed as low as the polar stratopause near 45 km altitude. ...
Full Text
- [Towards Modeling the Magnetospheric Space Plasma Environment](#) JUL 1999 141 pages
 Authors: [Michael Silevitch](#); [Elena Villalon](#); [NORTHEASTERN UNIV BOSTON MA](#)
 The research described in this report was focused into three related areas: (a) A study of nonadiabatic particle orbits and the electrodynamic structure of the coupled magnetosphere-ionosphere arc system. (b) An examination of electron acceleration and pitch angle scattering due to wave-particle interaction in the ionosphere and radiation belts. (c) A study of ionospheric modification research and the experimental results of Oedipus C satellite.
Full Text
- [HAARP Imaging Riometer Diagnostic](#) 16 JUL 1997 20 pages
 Authors: [Ted J. Rosenberg](#); [ADVANCED POWER TECHNOLOGIES INC WASHINGTON DC](#)
 This report describes the prototype 16-beam, 38.6 MHz riometer system developed by APTI and the University of Maryland for the HAARP program. The prototype system is the forerunner for a full-scale imaging riometer diagnostic instrument for characterizing the ionospheric volume perturbed by controlled RF heating experiments. The prototype system, installed at the HAARP site near Gakona, AK, consists of a 1 x 16 antenna array phased in one dimension (beam ...
Full Text
- [High-Energy Electron Beam-Induced Ionospheric Modification Experiments](#) 30 JUN 96 26 pages
 Authors: [Brian Gilchrist](#); [Torsten Neubert](#); [Linda H. Krause](#); [MICHIGAN UNIV ANN ARBOR SPACE PHYSICS RESEARCH LAB](#)
 The University of Michigan Space Physics Research Laboratory was given the task of providing scientific investigations of beam propagation physics associated with the injection of a MeV electron beam into the earth's atmosphere. Motivation for this study was driven by the reduction in weight and size of electron beam accelerators in this energy regime to the point which enables them to be flown on balloons, rockets, or spacecraft. Program goals ...
Full Text
- [A Diagnostic System for Studying Energy Partitioning and Assessing the Response of the Ionosphere During HAARP Modification Experiments](#) 15 MAY 96 55 pages
 Authors: [Frank T. Djuth](#); [John H. Elder](#); [Kenneth L. Williams](#); [GEOSPACE RESEARCH INC EL SEGUNDO CA](#)
 This research program focused on the construction of several key radio wave diagnostics in support of the HF Active Auroral Ionospheric Research Program (HAARP). Project activities led to the design, development, and fabrication of a variety of hardware units and to the development of several menu-driven software packages for data acquisition and analysis. The principal instrumentation includes an HF (28 MHz) radar system, a VHF (50 MHz) radar system, and ...
Full Text
- [Auroral and Midlatitude Radar Studies: Radar Methods for Improved Diagnostics of the HF-Modified and Natural Ionospheres](#) MAR 96 71 pages
 Authors: [Frank T. Djuth](#); [John H. Elder](#); [Kenneth L. Williams](#); [GEOSPACE RESEARCH INC EL SEGUNDO CA](#)
 This research program addresses fundamental issues related to the interaction of a high-power, high-frequency (3 - 10 MHz) radio wave with the ionosphere. Data acquired with incoherent scatter radars and a modest (50 kW) VHF radar were examined. The reported observations were made with the Arecibo HF modification facility in Puerto Rico and the Tromsø 'superheater' located in Norway. Particular attention is paid to the excitation of Langmuir and ...
Full Text
- [Investigation of Ionospheric Disturbances and Associated Diagnostic Techniques](#) 12 DEC 95 21 pages
 Authors: [L. M. Duncan](#); [CLEMSON UNIV SC](#)
 The objectives of this research and development program were to conduct simulation modeling of the generation and propagation of atmospheric acoustic signals associated with surface and subsurface ground disturbances; to construct an experimental measurement system for exploratory research studies of acoustic generated ionospheric disturbances; to model high power radio wave propagation through the ionosphere, including nonlinear wave plasma interaction effects; and to assist in the assessment of diagnostic systems for ...
Full Text
- [Characterization of Propagation and Communication Properties of the Natural and Artificially Disturbed Ionosphere](#) MAY 95 28 pages
 Authors: [Bobo W. Reinisch](#); [Gary S. Sales](#); [Ronald Brent](#); [Jens Ostergaard](#); [Yuming Huang](#); [MASSACHUSETTS UNIV LOWELL CENTER FOR ATMOSPHERIC RESEARCH](#)
 This basic research project, conducted during the period starting 12 September 1990 and ending 12 December 1994, studied the effects of natural and artificial ionospheric disturbances on HF and VHF propagation and communication. This project was reasonably divided into two parts where each stood by itself; VHF meteor scatter investigation and HF ionospheric modification studies. In addition to these two studies, a third study was later added to the project ...
Full Text
- [SATSIN System Manual](#) JAN 95 66 pages
 Authors: [Robert C. Livingston](#); [SRI INTERNATIONAL MENLO PARK CA](#)

Full Text This report outlines the design, functions and operation of the HAARP Diagnostic Satellite Scintillation (SATSIN) system that will be used to characterize the structure and dynamics of F region ionospheric irregularities created during HF heating. When in routine operation, the SATSIN system will be located so that the propagation path from satellite radio beacons passes through the heated volume created by HAARP. The signal, altered in phase and amplitude by ...

Science and Technology Text Mining: Pervasive Research Thrusts in the Former Soviet Union (FSU)

1995

26 pages

Authors: [Ronald N. Kostoff](#); [OFFICE OF NAVAL RESEARCH ARLINGTON VA](#)

Full Text A revolutionary approach to identifying pervasive thrust areas (and their relationships) in large textual databases was applied to a compendium of assessments of applied research areas in the Former Soviet Union (FSU) generated by the Foreign Applied Sciences Assessment Center (FASAC). Related thrust areas were combined to yield the following major thrust groupings: IONOSPHERIC HEATING/ MODIFICATION; IMAGE/ OPTICAL PROCESSING; AIR-SEA INTERFACE; LOW OBSERVABLE; EXPLOSIVE COMBUSTION; PARTICLE BEAMS; AUTOMATIC/ REMOTE CONTROL; ...

Innovative Development and Application of Models for Weakly Ionized Ionospheric Plasmas

NOV 93

76 pages

Authors: [J. V. Eccles](#); [James Hingst](#); [Russell Armstrong](#); [MISSION RESEARCH CORP NASHUA NH](#)

Full Text Artificial modifications of the ionosphere through chemical releases and ionospheric heating experiments are examined with models of chemistry and transport to advance understanding of ion chemistry of the upper atmosphere. The specific releases investigated were the SF6 released of the CRRES-at-Kwajalein rocket campaign and the CO2 releases of the Red Air I program. Both the SF6 and CO2 releases experienced freezing or clustering of the molecules. This must be accounted ...

Excitation of Earth-Ionosphere Waveguide in the ELF and Lower VLF Bands by Modulated Ionospheric Current

21 MAY 93

33 pages

Authors: [E. C. Field](#); [R. M. Bloom](#); [PACIFIC-SIERRA RESEARCH CORP SANTA MONICA CA](#)

Full Text In this report we use the principal of reciprocity in conjunction with a full-wave propagation code to calculate ground-level fields excited by ionospheric currents modulated at frequencies between 50 and 100 Hz with HF heaters. Our results show the dependence on source orientation, altitude, and dimension and therefore pertain to experiments using the HIPAS or HAARP ionospheric heaters. In the end-fire mode, the waveguide excitation efficiency of an ELF HED ...

Observation of Ionospheric Modification Using High Power Oblique HF transmissions

JUN 92

38 pages

Authors: [Gary S. Sales](#); [Yuming Huang](#); [MASSACHUSETTS UNIV LOWELL CENTER FOR ATMOSPHERIC RESEARCH](#)

Full Text A series of experiments were carried out during late May 1991 to investigate changes produced in the ionosphere by a high power HF transmitter operating at a frequency approximately two times the F-layer critical frequency. These high power oblique transmissions heated a region of the ionosphere some 1200km east of the Delano, CA Voice of America relay station, operating with an effective radiated power of 90 dBW. An HF probe ...

Ionospheric Modification by Powerful Radio Waves-the Suzdal Symposium (2th) Held in Tromso, Norway on September 1988

21 MAR 89

12 pages

Authors: [George J. Morales](#); [OFFICE OF NAVAL RESEARCH EUROPEAN OFFICE FPO NEW YORK 09510](#)

Full Text Presentations given at this conference, held in September 1988 at Tromso, Norway, are discussed. Topics include: parametric decay and Langmuir turbulence, electromagnetic emissions, satellite/rocket studies, large-scale density cavities, artificial ionization, and oblique heating. The author also reports on associated visits to EISCAT and the Swedish Institute in Uppsala. (RH)

Global Maps of foF2 Derived from Observations and Theoretical Values

31 JUL 1984

144 pages

Authors: [D. N. Anderson](#); [C. M. Rush](#); [M. Pokempner](#); [J. Perry](#); [F. G. Stewart](#); [NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION BOULDER CO](#)

Full Text Observations of the F2-region critical frequency, foF2, and values determined from the time-dependent continuity equation for ions and electrons in the ionosphere have been used to develop a new set of numerical coefficients to represent the global variation of foF2. The coefficients developed in this study, like those in earlier investigations, permit monthly median hourly values of foF2 to be obtained at any location around the globe for any month ...

Effect of the Ionosphere on Radiowave Systems, Held in Old Town, Alexandria, Virginia, 14-16 April 1981

1981

708 pages

Authors: [John M. Goodman](#); [NAVAL RESEARCH LAB WASHINGTON DC](#)

Full Text IES '81 is the third Ionospheric Effects Symposium to be sponsored by the Naval Research Laboratory. The purpose of this symposium was to improve the information transfer between system architects, managers, and designers on the one hand, and ionospheric physicists and propagation specialists on the other hand. The conference itself covered various topics of current interest to the ionospheric research community. Session topics included the following: Ionospheric Modification, General Reviews ...

Effect of the Ionosphere on Space Systems and Communications Based on the 1975 Ionosphere Effects Symposium Held in Crystal City, Arlington, Va. January

1975

510 pages

[20-22, 1975](#)

Authors: [John M. Goodman](#); [NAVAL RESEARCH LAB WASHINGTON DC](#)

[Full Text](#)

Ionosphere effect topics include scintillation, propagation, models, irregularities, and disturbances.

[Ionospheric Modification: Its Effects on Radar and Satellite Communication Systems](#)

OCT 1974

113 pages

Authors: [G. F. VanBlaricum](#); [H. S. Ostrowsky](#); [GENERAL RESEARCH CORP SANTA BARBARA CA](#)

[Full Text](#)

High-power RF radio transmissions have been used to create significant local disturbances of the temperature and electron density in the F- region of the ionosphere. This artificial modification of the ionosphere can create appreciable levels of amplitude and phase scintillation in radio signals passing through the disturbed region. The report describes and reorganizes some of the PRAIRIE SMOKE experimental data and presents a brief overview of scintillation theory. The experimental ...

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