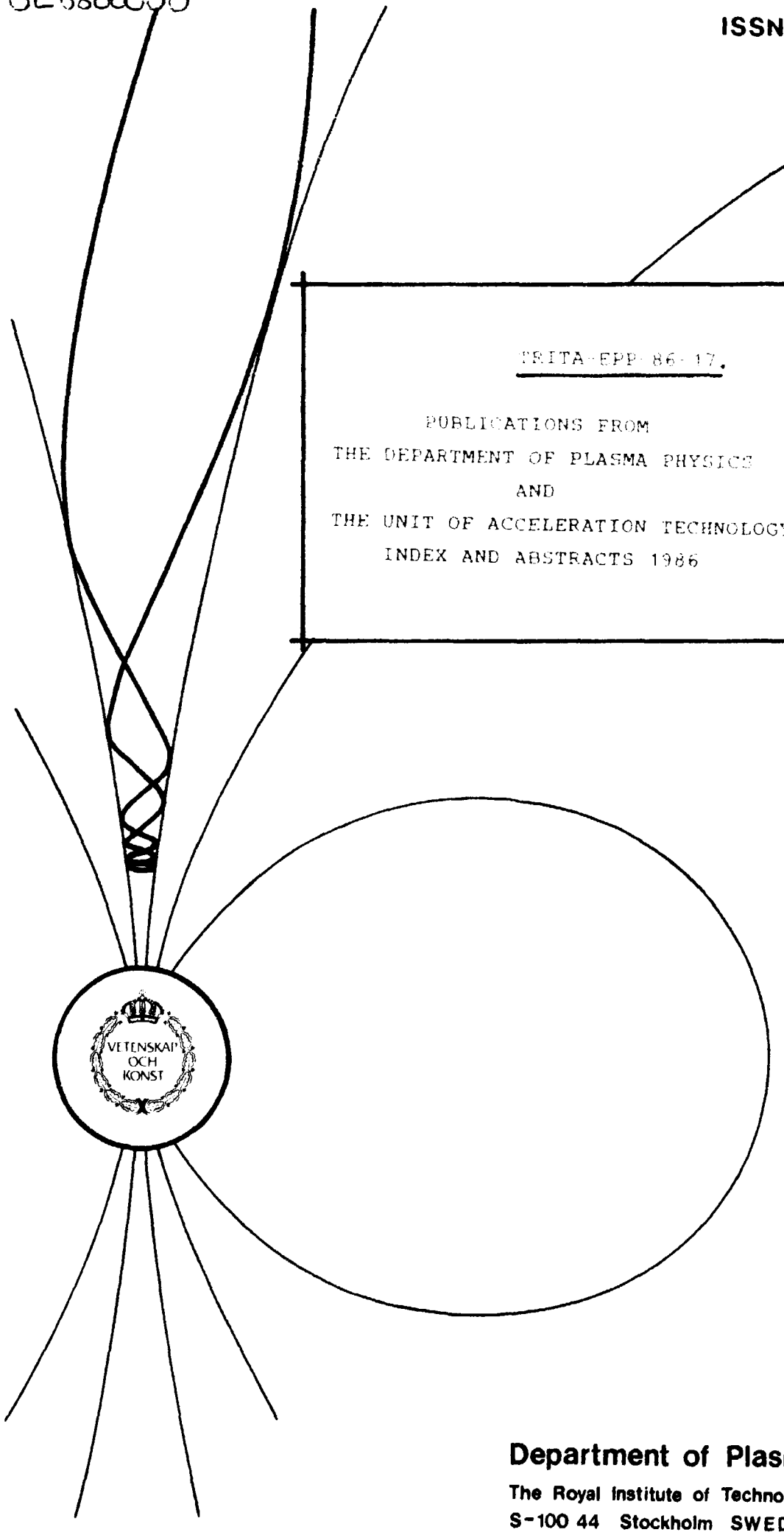
ISSN 0348-7539



TRITA-EPP-86-17

PUBLICATIONS FROM THE DEPARTMENT OF PLASMA PHYSICS AND THE UNIT OF ACCELERATION TECHNOLOGY

INDEX AND ABSTRACTS 1986

Department of Plasma Physics
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TRITA-EPP-86-17.

PUBLICATIONS FROM THE DEPARTMENT OF PLASMA PHYSICS AND THE UNIT OF ACCELERATION TECHNOLOGY INDEX AND ABSTRACTS 1986

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PUBLICATIONS IN 1986

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Alfvén, H., 1986: Model of the Plasma Universe, IEEE Transactions PS14, 629-638.

Alfvén, H., 1986: Double Layers and Circuits in Astrophysics, IEEE Transactions PS14, 779-793.

Alfvén, H., 1986: Viking and the Plasma Universe, Abstract to the AGU Fall Meeting in San Francisco 9-13 Dec. 1985, EOS 67, 1153.

Alfvén, H., Axnäs, I., Brenning, N., and Lindqvist, P.-A., 1986: Voyager Saturnian Ring Measurements and the Early History of the Solar System, Planet. Space Sci. 34, 145-154.

Block, L.P., Fälthammar, C.-G., Lindqvist, P.-A., Marklund, G., Pedersen, A., Mozer, F.S., 1986: High Altitude Electric Fields Measured by the Viking Satellite, Abstract to invited lecture at the AGU Fall Meeting, San Francisco, December 8-12 1986, EOS, 67, 1153.

Block, L.P., Rothwell, P.L., and Silevitch, M.B., 1986: A New Model for Substorm Breakup, Abstract to the AGU Fall Meeting in San Francisco, 8-12 december 1986, EOS, 67, 1178.

Carlqvist, P. 1986: On the Acceleration of Energetic Cosmic Particles by Electrostatic Double Layers, IEEE Transactions PS14, 794-799.

Erlandson, R.E., Zanetti, L.J., Potemra, T.A., Block, L.P., Fälthammar, C.-G., Lindqvist, P.-A., and Marklund, G., 1986: Initial Viking Results: Correlations Between Electric and Magnetic Fields at High Latitudes, Abstract to the AGU Fall Meeting in San Francisco, 8-12 december 1986, EOS, 67, 1155.

Fälthammar, C.-G., 1986: Magnetosphere-Ionosphere Interactions - Near Earth Manifestations of the Plasma Universe, IEEE Transactions PS14, 616-628.

Fälthammar, C.-G., 1986: The Earth's Magnetosphere as a Sample of the Plasma Universe, Proceedings of NASA OAST Workshop "Space Plasma Technology Issues in 2001", JPL Publication 86-49, 39-50.

Jørgensen, T.S., Marklund, G., and Block, L.P., 1986: Conjugate Measurements of Electric Fields on Viking and by the Søndre Strømfjord Radar, Abstract to the AGU Fall Meeting in San Francisco, December 8-12, 1986, EOS, 67, 1156.

Kremser, G., Korth, A., Ullaland, S., Stadsnes, J., Baumjohann, W., Block, L.P., Torkar, K.M., Riedler, W., Aparicio, B., Tanskanen, P., Iversen, I.B., Cornilleau-Wehrlin, N., Solomon, J., and Amata, E., 1986: Energetic Electron Precipitation During a Magnetospheric Substorm and Its Relationshiop to Wave Particle Interaction, J. Geophys. Res. 91, A5, 5711-5718.

Marklund, G.T., Heelis, R.A., and Winningham, J.D., 1986: Rocket and Satellite Observations of Electric Fields and Ion Convections in the Dayside Auroral Ionosphere, Can. J. Phys. 64, 1417-1425

Marklund, G.T., Blomberg, L., and Heelis, R., 1986b: Methods to Infer the Global High-Latitude Potential Distribution from Measured Birkeland Currents and Auroral Imager Data, Abstract to the AGU Fall Meeting in San Francisco, December 8-12, 1986, EOS 67, 1179.

Primdahl, F. and Marklund, G.T., 1986: Birkeland Currents Correlated with DC-Electric Fields Observed during the CENTAUR BBX Rocket Experiment, Can. J. Phys. 64, 1412-1416.

Raadu, M.A. and Chanteur, G., 1986: Formation of Double Layers, Shocklike Solutions of an mKdV Equation, Physica Scripta 33, 240-245.

Rothwell, P.L., Silevitch, M.B. and Block, L.P., 1986: Pi2 Pulsations and the Westward Travelling Surge, J. Geophys. Res. 91, A6, 6921-6928.

She, Z.S., Malherbe, J.-M., and Raadu, M.A., 1986: Transition Zone Effects on Thermal Non-Equilibrium and Plasma Condensation in Solar Coronal Loops, Astron. Astrophys, 164, No.2, 364-372.

The Viking Science Team (L.P. Block, C.-G. Fälthammar, P.-A. Lindqvist, G. Marklund, together with 63 other authors) 1986: The Viking Program, EOS, 67, 793-795.

Torvén, S., 1986: Weak Double Layers in a Current Carrying Plasma, Physica Scripta 33, 262-265.

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TRITA-EPP-86-01 ISSN 0348-7539

The Royal Institute of Technology, Department of Plasma Physics
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ON TRANSIENT ELECTRIC FIELDS OBSERVED IN CHEMICAL RELEASE EXPERIMENTS BY ROCKETS

G. Marklund, N. Brenning, G. Holmgren, and G. Haerendel
June 1986, 38 pp. incl. illus., in English

As a follow-up to the successful chemical release experiment Trigger in 1977, the TOR (Trigger Optimized Repetition) rocket was launched from Esrange on Oct. 24, 1984. Like in the Trigger experiment a large amplitude electric field pulse of 200 mV/m was detected shortly after the explosion. The central part of the pulse was found to be clearly correlated with an intense layer of swept up ambient particles behind a propagating shockfront. The field was directed towards the centre of the expanding ionized cloud, which is indicative of a polarisation electric field source. Expressions for this radial polarisation field and the much weaker azimuthal induced electric field are derived from a simple cylindrical model for the field and the expanding neutral cloud. Time profiles of the radial electric field are shown to be in good agreement with observations.

Key words: Electric fields, Polarisation electric fields, Birkeland currents, Shock wave propagation, Rocket experiments, Auroral arcs.

TRITA-EPP-86-02 ISSN 0348-7539

The Royal Institute of Technology, Department of Plasma Physics, Stockholm, Sweden

MAGNETOSPHERE-IONOSPHERE INTERACTIONS - NEAR EARTH MANIFESTATIONS OF THE PLASMA UNIVERSE

C-G Fälthammar

April 1986, 53 pp. incl. illustr., in English

As the universe consists almost entirely of plasma, the understanding of astrophysical phenomena must depend critically on our understanding of how matter behaves in the plasma state. In situ observations in the near Earth cosmical plasma offer an excellent opportunity of gaining such understanding. The near Earth cosmical plasma not only covers vast ranges of density and temperature, but is the site of a rich variety of complex plasma physical processes which are activated as a result of the interactions between the magnetosphere and the ionosphere.

The geomagnetic field connects the ionosphere, tied by friction to the Earth, and the magnetosphere, dynamically coupled to the solar wind. This causes an exchange of energy and momentum between the two regions. The exchange is executed by magnetic-field -aligned electric currents, the so-called Birkeland currents. Both directly and indirectly (through instabilities and particle acceleration) these also lead to an exchange of plasma, which is selective and therefore causes chemical separation. Another essential aspect of the coupling is the role of electric fields, especially magnetic field aligned ("parallel") electric fields, which have important consequences both for the dynamics of the coupling and, especially, for energization of charged particles.

Key words: Magnetosphere - Ionosphere Coupling, Electric Fields, Magnetic Fields, Acceleration, Plasma Universe

ISSN 0348 - 7539

TRITA-EPP-86-03
The Royal Institute of Technology, Department of Plasma Physics, Stockholm, Sweden

PLASMA UNIVERSE

H Alfvén

April 1986, 35 pp incl. illustr., in English

Traditionally the views on our cosmic environment have been based on observations in the visual octave of the electromagnetic spectrum, during the last half-century supplemented by infrared and radio observations.

Space research has opened the full spectrum. Of special importance are the X-ray-γ-ray regions, in which a number of unexpected phenomena have been discovered. Radiations in these regions are likely to originate mainly from magnetised cosmic plasmas. Such a medium may also emit synchrotron radiation which is observable in the radio region.

If we try to base a model of the universe on the plasma phenomena mentioned we find that the plasma universe is drastically different from the traditional visual universe.

Information about the plasma universe can also be obtained by extrapolation of laboratory experiments and magnetospheric in situ measurements of plasmas. This approach is possible because it is likely that the basic properties of plasmas are the same everywhere.

In order to test the usefulness of the plasma universe model we apply it to cosmogony. Such an approach seems to be rather successful. For example, the complicated structure of the Saturnian C ring can be accounted for. It is possible to reconstruct certain phenomena 4-5 billions years ago with an accuracy of better than 1%.

Keywords: Space research, x-rays, γ-rays, Plasma in space and laboratory, Evolution of the solar system

TRITA-EPP-84-04

The Royal Institute of Technology, Department of Plasma Physics
S-100 44 Stockholm, Sweden

DOUBLE LAYERS AND CIRCUITS IN ASTROPHYSICS

Hannes Alfvén
May 1986, 52 pp. incl. ill., in English

Abstract

As the rate of energy release in a double layer with voltage ΔV is $P \approx I\Delta V$, a double layer must be treated as a part of a circuit which delivers the current I. As neither double layer nor circuit can be derived from magnetofluid models of a plasma, such models are useless for treating energy transfer by menas of double layers. They must be replaced by particle models and circuit theory.

A simple circuit is suggested which is applied to the energizing of auroral particles, to solar flares, and to intergalactic double radio sources. Application to the heliospheric current systems leads to the prediction of two double layers on the sun's axis which may give radiations detectable from earth.

Double layers in space should be classified as a new type of celestial object (one example is the double radio sources). It is tentatively suggested in X-ray and γ-ray bursts may be due to exploding double layers (although annihilation is an alternative energy source).

A study of how a number of the most used textbooks in astrophysics treat important concepts like double layers, critical velocity, pinch effects and circuits is made. It is found that students using these textbooks remain essentially ignorant of

even the existence of these, in spite of the fact that some of them have been well known for half a century (e.g., double layers, Langmuir, 1929: pinch effect, Bennet, 1934). The conclusion is that astrophysics is too important to be left in the hands of the astrophysicist. Earth bound and space telescope data must be treated by scientists who are familiar with laboratory and magnetospheric physics and circuit theory, and of course with modern plasma theory. At least by volume the universe consists to more than 99% of plasma, and electromagnetic forces are 10^{39} time stronger than gravitation.

Key words: Plasmas, Currents in plasmas, Double layers as circuit elements, Exploding double layers, Relativistic double layers, Cosmic radiation, X-ray, γ-ray bursts, Pinch effect, Local versus global theories, Magnetopsheric-Heliospheric galactic currents.

TRITA-EPP-86-05 ISSN 0348-7539

The Royal Institute of Technology, Department of Plasma Physics, S-100 44 Stockholm, Sweden

THE CURRENT-VOLTAGE CHARACTERISTIC AND POTENTIAL OSCILLATIONS OF A DOUBLE LAYER IN A TRIPLE PLASMA DEVICE

R.T. Carpenter and S. Torvén

July 1986, 37 pp. incl. ill., in English

The properties of a strong double layer in a current circuit with a capacitance and an inductance are investigated in a triple plasma device. The double layer gives rise to a region of negative differential resistance in the current-voltage characteristic of the device, and this gives non-linear oscillations in the current and the potential drop over the double layer (Φ_{DL}). For a sufficiently large circuit inductance Φ_{DL} reaches an amplitude given by the induced voltage (-LdI/dt) which is much larger than the circuit EMF due to the rapid current decrease when Φ_{DL} increases.

A variable potential minimum exists in the plasma on the low potential side of the double layer, and the depth of the minimum increases when Φ_{DL} increases. An increasing fraction of the electrons incident at the double layer are then reflected, and this is found to be the main process giving rise to the negative differential resistance. A qualitative model for the variation of the minimum potential with Φ_{DL} is also proposed. It is based on the condition that the minimum potential must adjust itself self-consistently so that quasi-neutrality is maintained in the plasma region where the minimum is assumed.

Key words: Plasma, Triple plasma machine, Electric double layers, Double layers as circuit elements, Currents in plasma, Current disruptions.

TRITA-EPP-86-06 ISSN 0348-7539

The Royal Institute of Technology, Department of Plasma Physics
S-100 44 Stockholm, Sweden

CURRENT LIMITATION AND FORMATION OF PLASMA DOUBLE LAYERS IN A NON-UNIFORM MAGNETIC FIELD

R. Plamondon, J. Teichmann and S. Torvén
July 1986, 25 pp. incl. ill. in English

Formation of strong double layers has been observed experimentally in a magnetised plasma column maintained by a plasma source. The magnetic field is approximately axially homogeneous except in a region at the anode where the electric current flows into a magnetic mirror. The double layer has a stationary position only in the region of non-uniform magnetic field or at the aperture separating the source and the plasma column. It is characterized by a negative differential resistance in the current-voltage characteristic of the device. The parameter space, where the double layer exists, has been studied as well as the corresponding potential profiles and fluctuation spectra.

The electric current and the axial electric field are oppositely directed between the plasma source and a potential minimum which is formed in the region of inhomogeneous magnetic field. Electron reflection by the resulting potential barrier is found to be an important current limitation mechanism.

Key words: Laboratory plasma, Current limitation, Potential minimum, Double layer, Non-uniform magnetic field, Fluctuations, Azimuthal drift waves.

TRITA-EPP-86-07

Royal Institute of Technology, Department of Plasma Physics and Fusion Research, Stockholm, Sweden

VELOCITY LIMITATION OF A NEUTRAL DUST CLOUD COLLIDING WITH A MAGNETIZED PLASMA

B. Lehnert, August 1986, 15 p. in English

The problem is considered of a cloud of neutral dust which moves into a cloud of static plasma which is confined in a magnetic field. Earlier experiments and theoretical analysis on critical velocity limitation by plasma-wall interaction suggest that such limitation also arises in the case of plasma-neutral dust interaction. Nevertheless further analysis is required to provide a full and clear picture of the interaction between plasma and neutral gas on one hand and plasma and neutral dust on the other.

Key words: Plasma-neutral gas interaction, cosmic grains, critical velocity limitation.

TRITA-EPP-86-08 ISSN 0348-7539

The Royal Institute of Technology, Department of Plasma Physics
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ON THE ACCELERATION OF ENERGETIC COSMIC PARTICLES BY ELECTROSTATIC DOUBLE LAYERS

P. Carlqvist

September 1986, 25 pp. incl. illustr., in English

The capability of electrostatic double layers of accelerating charged particles to high energies is investigated. Starting from a one-dimensional, relativistic double layer model a two--dimensional, relativistic double layer in a current filament is studied. It is found that the filamentary double layer has a maximum potential drop that depends both on the magnitude of the filamentary current and on the composition of the layer. The results are applied to two cosmic double layers - one in a solar electric circuit and another in a galactic circuit. If the layers are composed of protons and electrons these particles may be accelerated to 10^{11} eV in the solar layer and to 10^{14} eV in the galactic layer. It is suggested that the solar double layer may account for the acceleration of solar cosmic rays while the galactic layer may contribute to the generation of cosmic radiation.

Key words: Double layer, Accelerator, Solar flare, Galactic circuit, Solar cosmic rays, Solar neutrons, Cosmic radiation

TRITA-EPP-86-09 ISSN 0348-7539

The Royal Institute of Technology, Department of Plasma Physics
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TESTING A VERY GOOD MICROWAVE INTERFEROMETER

Nils Brenning
September 1986, 19 pp. incl. ill., in English

A 4 mm microwave interferometer is described, together with a working system for numerical evaluation of the recorded signals. The interferometer signals are processed in a computer to provide immediate display of the plasma column density. The numerical evaluation makes it possible to eliminate the influence of also rather large imperfections in the components, and to take into account large and rapid variations in the strength of the transmitted microwave signal. The limits of performance of the system are tested in a pulsed plasma source. Column plasma densities are measured from 10^{15} m^{-2} to $3 \cdot 10^{18}$ m^{-2}, corresponding to phase swings from less than one degree up to several times 360^{o}. The upper limit corresponds to densities approaching the cutoff density, $6 \cdot 10^{19}$ m^{-3}, where reflection and refraction of the transmitted beam becomes severe. Measurements were possible even when the power in the transmitted branch was reduced (due to the plasma) by more than a factor 30, or when that power varied more as rapidly as a factor 4 in 200 ns.

Key words: Microwave interferometry, Plasma diagnostics, Plasma density measurements

TRITA-EPP-86-10 ISSN 0348-7539

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ON THE ROLE OF THE IONIZATION FREQUENCY TO GYROFREQUENCY RATIO IN THE CRITICAL IONIZATION VELOCITY INTERACTION

Nils Brenning
October 1986, 25 pp. incl. ill., in English

The role of the parameter v_i/ω_{ci} for critical ionization velocity (v_c-) interaction is discussed. This parameter, which can be seen as a combined condition on the neutral gas density and the magnetic field strength, is important for two different reasons. First, the value $v_i/\omega_{ci} = 1$ marks the limit between the regions of applicability of the homogeneous and the "ionizing front" (or inhomogeneous) models for the interaction. Second, it determines the energy transfer efficiency in the interaction. This energy transfer efficiency also depends strongly on whether the experiment is continous or transient in nature. In continous situations, the interaction has earlier been estimated to become gradully weaker when v_i/ω_{ci} decreases below unity. It is found here that efficient v_c-interation is possible at far lower values of v_i/ω_{ci} in transient experiment. The corresponding limit is approximately $v_i/\omega_{ci} = 10(m_e/m_i)^{3/2}\kappa^3$. Unfortunately, κ is a rather uncertain parameter: the number of instability growth times required for the modified two-stream instability to tap the energy of a thin ion stream in a plasma.

Key words: Critical velocity, Critical ionization velocity, Alfvén's critical velocity

TRITA-EPP-86-11 ISSN 0348-7539

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EXTENDED POTENTIAL DROPS PRECEDING DOUBLE LAYER FORMATION IN A TRIPLE PLASMA DEVICE

Martin Bohm and Staffan Torvén
December 1986, 6 pp incl. illus., in English

Experiments are reported showing that the formation of a double layer may be preceded by an extended potential drop (EPD), much thicker than the double layer. When a step voltage is applied between the two sources of a triple plasma device, the potential in the EPD varies quasi-linearly between the sources for time intervals up to 50 ion plasma periods (ω_{pi}^{-1}). For larger times the initially prevailing ion density distribution becomes significantly modified and the EPD then steepens to a double layer after about 500 à 1000 ω_{pi}^{-1} which roughly is an ion transit time between the sources.

Measurements with high frequency probes (bandwidth 3 MHz) at various frequencies within the region $10\ \omega_{pi} < \omega < 2\omega_{pe}$ show a broad spectrum of electric field fluctuations. When the EPD exists, the power level is between one and two orders of magnitudes larger than the level in the end of the time interval when a double layer has formed. These fluctuations are invoked to explain how quasi-neutrality is maintained, on an average, in the EPD.

Key words: Triple plasma device, Double layers, Extended potential drops, Electric field fluctuations

TRITA-EPP-86-12 ISSN 0348-7539

The Royal Institute of Technology, Department of Plasma Physics
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THE EARTH'S MAGNETOSPHERE AS A SAMPLE OF THE PLASMA UNIVERSE

Carl-Gunne Fälthammar
September 1986, 21 pp. in English

Plasma processes in the Earth's neighbourhood determine the environmental conditions under which space-based equipment for science or technology must operate. These processes are peculiar to a state of matter that is rare on Earth but dominates the universe as a whole. The physical, and especially the electrodynamic, properties of this state of matter is still far from well understood. By fortunate circumstances, the magnetosphere-ionosphere system of the Earth provides a rich sample of widely different plasma populations, and, even more importantly, it is the site of a remarkable variety of plasma processes. In different combinations such processes must be important throughout the universe, which is overwhelmingly dominated by matter in the plasma state. Therefore, observations and experiments in the near-Earth plasma serve a multitude of purposes. They will not only (1) clarify the dynamics of our space environment but also (2) widen our understanding of matter, (3) form a basis for interpretating remote observations of astrophysical objects, thereby even (4) help to reconstruct events that led to the evolution of our solar system. Last but not least they will (5) provide know-how required for adapting space-based technology to the plasma environment. Such observations and experiments will require a close mutual interplay between science and technology.

Key words: Astrophysics, Magnetosphere, Space Plasma, Electric currents, Electric fields

TRITA-EPP-86-13 ISSN 0348 7539

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MATERIAL EJECTA IN A DISTURBED SOLAR FILAMENT

Michael A. Raadu, Jean-Marie Malherbe, Brigitte Schmieder
and Pierre Mein
December 1986, 32pp., incl. ill., in English

Hα observations, using the Multichannel Subtractive Double Pass (MSDP) spectrograph operating on the Meudon Solar Tower, have been made of an active region filament which undergoes a " disparition brusque ". The period of observation was from 10:45 UT to 13:30 UT on 22 June, 1981. Velocity and intensity fluctuations in Hα were measured. The proper motions of ejecta were followed allowing their trajectories and vector velocities to be determined. To model the dynamics of ejecta several models using thermal or magnetic driving forces are compared. The most promising model explains the motion as the consequence of magnetic stresses acting on an isolated magnetized plasmoid in a diverging flux tube.

Key words: Filaments, Material ejecta, Plasmoids, Magnetohydrodynamics.

TRITA-EPP-86-14 ISSN 0348-7539

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FORMATION OF SHOCKLIKE MKDV SOLITONS: APPLICATION TO DOUBLE LAYERS

Gérard Chanteur and Michael A. Raadu
December 1986, 47 pp. incl. illus., in English

In some commonly occurring situations, such as a stratified fluid with two layers or a plasma with a two-temperature electron component, the long waves are adequately described by a Korteweg-de Vries (KdV) equation having positive or negative solitary wave solutions, depending upon the sign of the quadratic term. For critical values of the physical parameters, the quadratic nonlinearity vanishes and the KdV is replaced by a modified KdV (or mKdV) equation. This paper concerns the mKdV equation having a cubic nonlinearity with a negative coefficient. The initial value problem with different asymptotic levels, u_1 far to the left and u_2 far to the right, is investigated both analytically and numerically, for this mKdV$^-$ equation. The necessary and sufficient condition $u_1u_2 < 0$ is demonstrated for a shocklike solution to form, also named double layer (DL) in plasma physics.

Key words: Solitons, Shocks, Double layers, Ion-acoustic waves, Non-linear waves, Modified Korteweg-de Vries equation, Inverse scattering theory, Numerical solutions, Pseudo-spectral scheme

TRITA-EPP-86-15 ISSN 0348-7539

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A SYNTHETIC PLASMA SOURCE

L. Lindberg
December 1986, 9 pp. incl. ill.,in English

A synthetic plasma source is described, producing a plasma beam with low temperature and nearly maxwellian electron distribution. Two thermionic cathodes are used; one supplying energetic electrons that ionize the gas, the other, a lanthanum hexaboride plate in contact with the plasma, supplying thermal electrons.

Key words: Plasma source, Boride cathode, Electrostatic phenomena, Double layers

TRITA-EPP-86-16

Royal Institute of Technology, Department of Plasma Physics and Fusion Research, Stockholm, Sweden

ON THE POSSIBLE EXISTENCE OF LONGITUDINAL ELECTRIC SPACE-CHARGE WAVES

B. Lehnert, December 1986, 16 p. in English

According to an earlier proposed Lorentz invariant extension of Maxwell's equations, longitudinal electric waves should exist in addition to transverse electromagnetic waves. This paper concentrates on further analysis of the longitudinal waves. The generation and detection of such possibly existing waves is not straight-forward, because most physical systems are expected to create a mixture of transverse and longitudinal waves, and the amplitude of the latter is expected to be much smaller than that of the former. A special arrangement for an experimental test of the longitudinal waves is outlined in which the geometry of the generator and detector systems and the time development of the generator current are chosen such as to minimize recorded magnetic disturbances.

The existence or non-existence of the space charge wave could have a bearing on the existence or non-existence of stationary electromagnetic equilibrium states, but not by absolute necessity.

Key words: Electromagnetic field theory, wave phenomena.