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~~Thruster World's First Ion Thruster Powered Boat! Weekend Project: Ionic Space Thruster Air Breathing Ion Thrusters \u0026 Low Orbit Satellites~~ Plasma Characterization Of Hall Thruster

Many kinds of plasma oscillations have been known to exist in Hall thrusters.<sup>14</sup> Since the 1960's, numerous studies have been performed to characterize these oscillations.<sup>15-29</sup> In the current generation of Hall thrusters, there are three oscillation modes that dominate the oscillation spectra, the breathing mode, the spokes mode, and the cathode gradient-driven mode.

Plasma Oscillation Characterization of NASA's HERMeS Hall ... Non-emissive electrodes and ceramic spacers placed along the Hall thruster channel are shown to affect the plasma potential distribution and the thruster operation. These effects are associated

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with physical properties of the electrode material and depend on the electrode configuration and geometry and the magnetic field distribution.

Plasma characterization of hall thruster with active and ...

The plasma in the Hall thruster possesses Rayleigh-Taylor instability, resistive instability, transit time instability, electromagnetic instability and sheath instabilities [5, 6, 7, 8, 9, 10, 11]. These systems are rampant with plasma instabilities and fluctuations, many of which are responsible for performance, driving electron transport across magnetic field lines and contributing to propellant ionization.

Hall Thruster: An Electric Propulsion through Plasmas ...

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Characterization of Hall Effect Thruster Plasma Oscillations based on the Hilbert-Huang Transform IEPC-2005-46 Presented at the 29th International Electric Propulsion Conference, Princeton University October 31 November 4, 2005

## CHARACTERIZATION OF HALL EFFECT THRUSTER PLASMA ...

Hall Thruster Discharge Chamber Plasma Characterization. Using a High-Speed Axial Reciprocating Electrostatic Probe. James M. Haas§, Richard R. Hofer' and Alec D. Gallimore. Plasmadynamics and Electric Propulsion Laboratory. Department of Aerospace Engineering.

Hall Thruster discharge chamber plasma characterization ...

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Low-Power Operation and Plasma Characterization of a  
Qualification Model SPT -140 Hall Thruster for NASA Science  
Missions Charles E. Garner<sup>1</sup>, Benjamin A. Jorns<sup>2</sup>, Steven van  
Derventer,<sup>3</sup> and Richard R. Hofer<sup>4</sup> Jet Propulsion laboratory,  
California Institute of Technology, Pasadena, CA 91109 Ryan  
Rickard<sup>5</sup>, Raymond Liang<sup>6</sup> and Jorge Delgado<sup>7</sup>

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Low-Power Operation and Plasma Characterization of a ...  
the 6-kW Hall thruster. This probe was selected due to its simplicity and ability to measure several plasma properties such as number density, electron temperature, floating and plasma potentials, and EEDFs. However, the analysis of Langmuir probe data in order to obtain these properties can be complex due to various effects causing

Near-Wall Plasma Characterization of a 6-kW Hall Thruster  
In spacecraft propulsion, a Hall-effect thruster is a type of ion thruster in which the propellant is accelerated by an electric field. Hall-effect thrusters use a magnetic field to limit the electrons' axial motion and then use them to ionize propellant, efficiently accelerate



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the ions to produce thrust, and neutralize the ions in the plume. Hall-effect thrusters are sometimes referred to as Hall thrusters or Hall-current thrusters. The Hall-effect thruster is classed as a moderate specific imp

Hall-effect thruster - Wikipedia

Experimental and Theoretical Characterization of a Hall Thruster Plume by Yassir Azziz S.B., Aeronautics and Astronautics, Massachusetts Institute of Technology, 2001 ... of a Hall thruster from laboratory measurements and characterizes the plasma properties of the in-orbit plume.

Experimental and Theoretical Characterization of a Hall ...  
Plasma Characterization of Hall Thruster with Active and Passive

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Segmented Electrodes Y. Raitses, D. Staack and N. J. Fisch  
Princeton Plasma Physics Laboratory, Princeton, NJ 08540 Abstract  
voltage to the positive side electrode, the possibility of a two Non-emissive electrodes and ceramic spacers placed along the Hall thruster channel are shown

Plasma Characterization of Hall Thruster with Active and ...  
OSTI.GOV Technical Report: Plasma Characterization of Hall Thruster with Active and Passive Segmented Electrodes

Plasma Characterization of Hall Thruster with Active and ...  
characterization of far-field plume plasma is essential to comprehensively understand the ion dynamics properties, and construct a complete picture of plume plasma within a medium

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power Hall thruster. Moreover, the measurement results can provide data for the validation of numerical simulation

The far-field plasma characterization in a 600 W Hall ... Plasma potentials and electron temperatures were deduced from emissive and cold floating probe measurements in a 2 kW Hall thruster, operated in the discharge voltage range of 200–400 V.

(PDF) Characterization of plasma in a Hall thruster ... Non-intrusive characterization of the singly ionized xenon velocity in Hall thruster plume using laser induced fluorescence (LIF) is critical for constructing a complete picture of plume plasma, deeply understanding the ion dynamics in the plume, and providing validation data for numerical simulation.

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The far-field plasma characterization in a 600 W Hall ...

Potential drop in the 100 W cylindrical Hall thruster is localized mainly in the cylindrical part of the channel and in the plume, which suggests that the thruster should suffer lower erosion of the channel walls due to fast ion bombardment. Plasma density has a maximum of about  $(2.6 \text{ } 3.8) \times 10^{12} \text{ cm}^{-3}$  at the thruster axis. At the discharge voltage of 300 V, the maximum electron temperature is about 21 eV, which is not enough to produce multiple ionization in the accelerated flux of Xe<sup>+</sup> ions [3].

Characterization of Plasma in a Miniaturized Cylindrical ...

Performance characterization of a low-power magnetically shielded Hall thruster with an internally-mounted hollow cathode 21 October

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2019 | Plasma Sources Science and Technology, Vol. 28, No. 10  
Evidence of Counter-Streaming Ions near the Inner Pole of the HERMeS Hall Thruster

Plasma Oscillation Characterization of NASA's HERMeS Hall ...

A Hall thruster uses ionized xenon as a propellant for space propulsion applications. The heat produced by thruster components and the xenon plasma transfers to space and the spacecraft, impacting thruster and spacecraft design, as well as thruster efficiency and lifetime.

Characterization of a Hall Effect Thruster Using Thermal ...

During the development phase, the laboratory-model NASA 173M Hall thrusters were designed and their performance and plasma

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characteristics were evaluated. Experiments with the NASA-173M version 1 (v1) validated the plasma lens magnetic field design.

Throughout most of the twentieth century, electric propulsion was considered the technology of the future. Now, the future has arrived. This important new book explains the fundamentals of electric propulsion for spacecraft and describes in detail the physics and characteristics of the two major electric thrusters in use today,

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ion and Hall thrusters. The authors provide an introduction to plasma physics in order to allow readers to understand the models and derivations used in determining electric thruster performance. They then go on to present detailed explanations of: Thruster principles Ion thruster plasma generators and accelerator grids Hollow cathodes Hall thrusters Ion and Hall thruster plumes Flight ion and Hall thrusters Based largely on research and development performed at the Jet Propulsion Laboratory (JPL) and complemented with scores of tables, figures, homework problems, and references, *Fundamentals of Electric Propulsion: Ion and Hall Thrusters* is an indispensable textbook for advanced undergraduate and graduate students who are preparing to enter the aerospace industry. It also serves as an equally valuable resource for professional engineers already at work in the field.

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Plasma Engineering, Second Edition, applies the unique properties of plasmas (ionized gases) to improve processes and performance over many fields, such as materials processing, spacecraft propulsion and nanofabrication. The book considers this rapidly expanding discipline from a unified standpoint, addressing fundamentals of physics and modeling, as well as new and real-world applications in aerospace, nanotechnology and bioengineering. This updated edition covers the fundamentals of plasma physics at a level suitable for students using application



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examples and contains the widest variety of applications of any text on the market, spanning the areas of aerospace engineering, nanotechnology and nanobioengineering. This is highly useful for courses on plasma engineering or plasma physics in departments of Aerospace Engineering, Electrical Engineering and Physics. It is also useful as an introduction to plasma engineering and its applications for early career researchers and practicing engineers. Features new material relevant to application, including emerging areas of plasma nanotechnology and medicine Contains a new chapter on plasma-based control, as well as a description of RF and microwave-based plasma applications, plasma lighting, reforming and other most recent application areas Provides a technical treatment of the fundamental and engineering principles used in plasma applications

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Introduction to Plasmas and Plasma Dynamics provides an accessible introduction to the understanding of high temperature, ionized gases necessary to conduct research and develop applications related to plasmas. While standard presentations of introductory material emphasize physics and the theoretical basis of the topics, this text acquaints the reader with the context of the basic information and presents the fundamental knowledge required for advanced work or study. The book relates theory to relevant devices and mechanisms, presenting a clear outline of analysis and mathematical detail; it highlights the significance of the concepts with reviews of recent applications and trends in plasma engineering, including topics of plasma formation and magnetic fusion, plasma thrusters and space propulsion. Presents the essential

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principles of plasma dynamics needed for effective research and development work in plasma applications Emphasizes physical understanding and supporting theoretical foundation with reference to their utilization in devices, mechanisms and phenomena Covers a range of applications, including energy conversion, space propulsion, magnetic fusion, and space physics.

This report investigates I dimensional and 2 dimensional hall effect thruster models to better understand the following physics related issues: radial structure of the plasma, lateral wall effects, physics of the subsonic region, no near-total ionization regimes, effects of secondary electron emission from the walls, and reduction of the growth rate of self oscillations.

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This book provides a systematic introduction to the physics of plasma diagnostics measurements. It develops from first principles the concepts needed to plan, execute and interpret plasma measurements, making it a suitable book for graduate students and professionals with little plasma physics background. The book will also be a valuable reference for seasoned plasma physicists, both experimental and theoretical, as well as those with an interest in space and astrophysical applications. This second edition is thoroughly revised and updated, with new sections and chapters covering recent developments in the field.

In an effort to understand the technical issues related to running multiple Hall effect thrusters in close proximity to each other, testing of a cluster of four Busek BHT-200-X3 devices has begun in

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Chamber 6 at the Air Force Research Laboratory. Preliminary measurements have shown that the variations in the discharge currents of the four thrusters are synchronized, possibly due to cross talk through the thruster plumes. Measurements of plasma density, electron temperature, and plasma potential in the thruster plumes obtained using a triple Langmuir probe are presented. Anomalously high electron temperatures were recorded along the centerline of each thruster. Collisionless, magnetosonic shock waves induced by the ion-ion two-stream instability are proposed as a possible cause of the high temperatures. The unperturbed ion velocity distribution along the centerline of a Hall thruster is shown to be unstable and a simple geometric model is presented to illustrate the qualitative changes in plasma properties expected across the proposed shock. Estimates using this model show that relatively large changes in

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electron temperature are consistent with small changes in electron number density across a shock. Qualitative arguments are presented indicating that collisionless shocks are unlikely to form as a result of clustering multiple thrusters. In an effort to understand the technical issues related to running multiple Hall effect thrusters in close proximity to each other, testing of a cluster of four Busek BHT-200-X3 devices has begun in Chamber 6 at the Air Force Research Laboratory. Preliminary measurements have shown that the variations in the discharge currents of the four thrusters are synchronized, possibly due to cross talk through the thruster plumes. Measurements of plasma density, electron temperature, and plasma potential in the thruster plumes obtained using a triple Langmuir probe are presented.

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