

# Langmuir Probe In Theory And Practice

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Electrical Probes for Plasma Diagnostics  
Electric Probes in Stationary and Flowing Plasmas  
Fundamentals of Plasma Physics  
Nuclear Science Abstracts  
Langmuir Probe Theory and Analysis  
A GENERAL PROBE THEORY FOR MEASUREMENTS IN A PLASMA.  
Handbook of Advanced Plasma Processing Techniques  
Theory of Spherical and Cylindrical Langmuir Probes in a Collisionless, Maxwellian Plasma at Rest  
U.S. Government Research & Development Reports  
Theory of the Resonance Probe  
Probe measurements and determination of electron mobility in th...  
The Use of Electrostatic Probes to Characterize the Discharge Plasma Structure and Identify Discharge Cathode Erosion Mechanisms in Ring-cusp Ion Thrusters  
Probe Theory in a Dense Plasma  
Journal of the Franklin Institute  
Evaluation of Ion Density and Plasma Potential from Langmuir Probe Data  
The Lancet-clinic  
Bibliography of Scientific and Industrial Reports  
Technical Information Pilot Medical Times  
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from flat panel televisions to thermonuclear fusion for energy production plasmas currently have

numerous and wide applications in sciences and industry a diversity of plasma diagnostics is available to physicists and engineers to measure and control plasma parameters among them the langmuir probe is the most inexpensive and most popular instrument and method the langmuir probe is a small electrode which is submerged in plasma in order to measure the probe current voltage characteristic the same characteristic is processed further to derive the electron and ion concentration the electron distribution function and the plasma potential at the probe location langmuir probe diagnostics afford rapid measurements of the electron distribution function and plasma potential at a good time resolution 10<sup>-8</sup> seconds in a wide range of plasma densities 10<sup>-3</sup> to 10<sup>14</sup> cm<sup>-3</sup> and the electron energy from the room temperature to hundreds of electron volts quantities which are essential for researchers in view of these facts langmuir probe diagnostics are applied very frequently to measuring plasma parameters this book will be useful in teaching plasma diagnostics to undergraduate and graduate students in plasma physics courses and it will also serve as a practical reference manual for physicists and engineers working in the growing area of plasma physics the reader of this book will learn what kind of plasma parameters the langmuir probe can measure how to develop the probe diagnostics for specific cases and how the probe data obtained should be processed to deduce reliable plasma parameters in this book the reader can find not only the basic physics information important to understanding the principles of probe operation but also how the real probe disturbs plasma and how it is possible to reconstruct undisturbed plasma parameters with available probe data

the electric probe has long been used as a fundamental diagnostic tool for measuring the local properties of a plasma since langmuir first developed the electric probe technique in 1924 probes have been used to measure electron densities and temperatures in a wide variety of gaseous ionized media such as electric discharges afterglows ionizing shock waves flames mhd and plasma jet flows reentry vehicle flow fields and atmospheric and space plasmas the first systematic account of modern theories of electric probe behavior was given by chen 1965 who also provided practical information on experimental techniques a subsequent survey by swift and schwar 1970 which was representative of results contained in the literature through 1969 included additional information on some of the modern theories and on practical details of probe utilization the purpose of this volume is to supplement the previously mentioned two works by providing an account of a large body of the up to date information available on electric probes particularly in the areas of transitional and continuum flow phenomena and by offering for all domains of probe application a critical appraisal of the more significant probe theories and experimental investigations in the literature

this rigorous explanation of plasmas is relevant to diverse plasma applications such as controlled

fusion astrophysical plasmas solar physics magnetospheric plasmas and plasma thrusters more thorough than previous texts it exploits new powerful mathematical techniques to develop deeper insights into plasma behavior after developing the basic plasma equations from first principles the book explores single particle motion with particular attention to adiabatic invariance the author then examines types of plasma waves and the issue of landau damping magnetohydrodynamic equilibrium and stability are tackled with emphasis on the topological concepts of magnetic helicity and self organization advanced topics follow including magnetic reconnection nonlinear waves and the fokker planck treatment of collisions the book concludes by discussing unconventional plasmas such as non neutral and dusty plasmas written for beginning graduate students and advanced undergraduates this text emphasizes the fundamental principles that apply across many different contexts

nsa is a comprehensive collection of international nuclear science and technology literature for the period 1948 through 1976 pre dating the prestigious inis database which began in 1970 nsa existed as a printed product volumes 1 33 initially created by doe s predecessor the u s atomic energy commission aec nsa includes citations to scientific and technical reports from the aec the u s energy research and development administration and its contractors plus other agencies and international organizations universities and industrial and research organizations references to books conference proceedings papers patents dissertations engineering drawings and journal articles from worldwide sources are also included abstracts and full text are provided if available

this report develops a unified theoretical representation of the spherical langmuir probe in a collision dominated weakly ionized gas the analysis is performed by numerically integrating poisson s equation and a set of moment equations derived from the boltzmann equation that conserve mass momentum and energy for electrons and ions the theory provides for the continuous description of langmuir probes from collisionless through collision dominated conditions numerical techniques are developed to carry out the analysis the numerical results show that the theoretical model satisfies all known theoretical limits for collisionless and collision dominated operating conditions a new model for langmuir probe data analysis is developed the model provides for the description of sheaths of finite thickness and is found to meet all known theoretical limits in the collisionless and collision dominated extremes and provides a continuous description of operating conditions between these extremes systematic data analysis procedures employing the new data analysis model are developed the feasibility of performing a langmuir probe experiment in a thermodynamic equilibrium cesium plasma for the purpose of validating theoretical probe models under experimental conditions where plasma properties are known from thermodynamic relations is investigated

the standard model of floating probes in plasmas is reviewed it is shown that a maximum charge density exists for the application of this model an explicit expression of voltage applied to the probes in terms of circuit current is obtained when certain simplifying assumptions are used this equation is reduced to the langmuir single probe equation and the johnson malter double probe equation from measurements of probe current versus applied probe voltage electron temperature at each respective probe can be determined one example is given to illustrate the calculation

this volume covers the topic of advanced plasma processing techniques from the fundamental physics of plasmas to diagnostics modeling and applications such as etching and deposition for microelectronics the use of plasmas for patterning on a submicron scale has enabled successive generations of continually smaller transistors lasers micromachines sensors and magnetic read write heads that have formed the basis of our information age this volume is the first to give coverage to this broad area of topics in a detailed fashion especially in the rapidly expanding fields of micro mechanical machines photomask fabrication magnetic data storage and reactor modeling it provides the reader with a broad array of topics authored by the leading experts in the field

a method was developed and used to obtain theoretical predictions of the current collected from a collisionless fully maxwellian plasma at rest by an electrically conducting langmuir probe having spherical or cylindrical symmetry the probe characteristic or functional relation between current and probe potential was determined for both geometries for probe radii up to 100 times the debye shielding distance of the hotter species of charged particle for a complete range of ion to electron temperature ratios and for probe potentials from 25 to 25 times the thermal energy of the hotter species each current collection result is computed to a relative accuracy of 0.002 or better in an average time of approximately two minutes on the ibm 7094 explicit comparison is made between the results for a completely maxwellian plasma and those for a plasma mono energetic in attracted particles as treated by bernstein and rabinowitz lam and chen it is shown that in certain cases the mono energetic plasma does not adequately simulate the maxwellian plasma

a dense plasma is defined as one in which the effective mean free path of one particle component is small in comparison with the probe dimensions thus langmuir's theory is not applicable in such a plasma the presence of the probe causes marked changes of density and potential distributions in the probe environment these effects were calculated for insulated probes of various geometries an exact solution is given for a concentric cylindrical probe for more general geometries an appropriate approximation procedure the composition method was developed from variational principles the effect of probe disturbances on the measurements can be accounted for in terms of an effective probe position and a potential correction introduction of the probe also causes changes in the eigenvalue and electron temperature the results allow one to unfold experimental data to

find the true plasma qualities consideration of the inertia limited region shows that bohm s criterion is not suitable to judge either the stability or stationarity of the sheath a stationary inertia limited region can exist only under certain restricted circumstances auth

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