



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم



MONA MAGHRABY



شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم



شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلم



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جامعة عين شمس التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغييرات



يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار



MONA MAGHRABY

Ain Shams University
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Physics Department



Experimental Discharge Characterization of Inertial Electrostatic Confinement (IEC) Fusion Plasma Device

A Thesis

Submitted in Partial Fulfillment for the Requirements of the Ph.D. Degree of
Science in Physics (Nuclear Physics)

Presented By

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2021

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



وما توفيقى الا بالله

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Approval Sheet

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Dedication

To

My Parents

To

My Husband

And

My Children

Acknowledgments

Acknowledgments

First and foremost praising to my god, Allah who led me through this work, sustains me with the power and will to do this work.

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Abstract

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The inertial electrostatic confinement fusion device had been designed and constructed in Plasma and Nuclear Fusion Department, Atomic Energy Authority.

The signals of discharge current for air and hydrogen plasmas were recorded in a digitizing oscilloscope by using the current monitor. The IECF process realizes high currents, this result in an increase in reaction rates.

IECF plasma optical signals were recorded using air, helium, argon, and hydrogen gases by using photomultiplier tube which contains optical fiber, where the light that passes through the fiber was directed to the photomultiplier connected to the digital oscilloscope.

Measurements of the total "amount" of visible light using a lux meter for air, helium, argon, and hydrogen gases at different pressures showed that, illuminance of visible light increased by increasing the pressure.

Paschen discharge was measured for IECF air, helium, argon, and hydrogen plasmas, then the determined breakdown voltage showed a minimum value denoted as $(V_{br})_{min}$ at the intermediate of Paschen discharge denoted as $(Pd)_{min}$.

The effects of IECF hydrogen plasma on lung cancer cell-line for different exposure doses (60 and 80 sec.) were found to depend on the exposure time, and were compared with (6Gy) ^{60}Co gamma irradiation. Evaluation of its effect coming through two types of analysis; the first was (MTT) assay, the level of viability showed significant decrease in all treated groups and increasing the time of exposure leads to a good treatment. The second technique was

Abstract

molecular proteomics assay for two genes, Caspase 10 and P16. The results proved that, the plasma products lead to increase in the transcriptional levels of Caspase 10 and P16 genes which produce degradative effects on malignant cells (apoptotic gene and tumor suppressor gene, respectively).

List of Abbreviations and Symbols

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Ac	Alternating Current
Ar	Argon
ATP	Atmospheric Temperature Plasma
a.u	Arbitrary Unit
CCD	Charge Coupled Device
CCZ	Co-Central Zones
CK20	Cytokeratin 20
Dc	Direct Current
DMEM	Dulbecco's Modified Eagle Medium
DMH	Dimethyl Hydrazine
DMSO	Dimethyl Sulpho Oxide
d	Distance
E	Electric Field
E/P	Reduced Electric Field
eV	Electron Volt
EMEM	Eagle Minimum Essential Medium
EMN	Electromagnetic Noise

List of Abbreviations and Symbols

EMR	Electromagnetic Radiation
EMT	Epithelial Mesenchymal Transition
FBS	Fetal Bovin Serum
FCS	Fetal Calf Serum
FWHM	Full Width at Half Maximum
GBM	Glio Blastoma Multiforme
Gy	Gray
H ₂	Hydrogen
He	Helium
IEC	Inertial Electrostatic Confinement
IECF	Inertial Electrostatic Confinement Fusion
IEDF	Ion Energy Distribution Function
I	Discharge Current
IL	Interleukin
IR	Infrared
ITER	International Thermonuclear Experimental Reactor
kV	Kilo-Volt
K	Kelvin

List of Abbreviations and Symbols

LIF	Laser Induced Fluorescence
LTE	Local Thermal Equilibrium
MDR	Multidrug Resistance
MEM	Minimum Essential Medium
e	Electron Density
i	Ion Density
NIF	National Ignition Facility
OD	Optical Density
Osc	Oscilloscope
P	Pressure
PAGE	Poly Acrylamide Gel Electrophoresis
PARP	Poly Adp-Ribose Polymerase
PIC	Particle-In-Cell
PMT	Photomultiplier Tube
PW	Potential Well
ROS	Reactive Oxygen Species
RF	Radio Frequency
SE	Standard Error

List of Abbreviations and Symbols

Sec	Second
SCFH	Standard Cubic Feet per Hour
SDS-PAGE	Sodium Dodecyl Sulphate-Poly Acrylamide Gel Electrophoresis
S.G.P.T.	Serum Glutamate Pyruvate Transaminase
S.G.O.T.	Serum Glutamate Oxalate Transaminase
SSR	Solid State Relays
SDS	Sodium Dodecyl Sulphate
SPMT	Scintillator Photomultiplier Tube
T_i	Ion Temperature
T_e	Electron Temperature
T_g	Gas Temperature
TNF- α	Tumor Necrosis Factor
UHF	Ultra High Frequency
USB	Universal Serial Bus
UV	Ultraviolet
V	Applied Voltage
V_{br}	Breakdown Voltage
σ	Cross Section

List of Abbreviations and Symbols

α (TFIC)	Townsend First Ionization Coefficient
γ (TSIC)	Townsend Second Ionization Coefficient
γ ray	Gamma Radiation
μs	Micro-Second
ν	Oscillation Frequency