Holcombe Department of Electrical and Computer Engineering
Seminar Series

Propagation of Plasma Wave-Packet As a Plasma Bullet in Plasma Jets

Dr. Guangsup Cho
Department of Electrophysics
Kwangwoon University

Abstract
The velocity of plasma bullet is known to be (104-105) m/s in the plasma jet experiments. To explain the high propagation velocity of the plasma bullet under a very weak field condition, Lu and Laroussi have explained a photo-ionization based model. However, the mechanism of bullet propagation has not been understood clearly. Similar to the propagation of plasma bullet, the observation of wave-packet propagation in a long positive column discharge tube has been reported2-4 where the wave-packet speed is the same as that of plasma bullet in the pencil-type plasma jet devices.

In this study the plasma bullets are analyzed to be an ion plasma wave-packet propagating by the plasma density gradient along a plasma plume. When a high density plasma is generated at the high field region of plasma jet device, the plasma diffuses longitudinally to be formed the plasma plume column of low electric field. At the steady state the background plasma column has a diffusion velocity due to a plasma density gradient. The ion plasma wave is generated by the pulses of the operating frequency having a several 10s kHz and it propagates along the plasma plume column without damping due to the plasma density gradient. The wave packet of ion plasma wave has the group velocity $v_g = v_{ac}/n = (104-105)$ m/s where the ion acoustic velocity is $v_{ac} = 103$ m/s and the plasma diffusion velocity $v_n = (101-102)$ m/s in the plasma jet column of low electric field. In the conclusion, the plasma bullet is the ion wave-packet propagating along the plasma column having a plasma density gradient.

Biography of Speaker

Professor Guangsup Cho received the B.S. degree in Physics from Seoul National University in 1980 and M.S. degree from Korea Advanced Institute of Science Technology (KAIST) in 1982. He was awarded the Ph.D. degree in plasma physics from the University of Korea Advanced Institute of Science Technology (KAIST) in 1993, both in plasma physics. Dr. Cho has industrial experience in both LCD-BLU and Bio-Plasma. From 1988 to now he has been a Professor in the Department of Electrophysics at Kwangwoon University, and from 1992 to 1993 he was a Visiting Researcher in MIT(Research Lab. of Electronics) at Boston and from 2001 to 2002 he was a Visiting Professor in UC Berkeley. He also had been the head of Planning and Management at Kwangwoon University from 1994 to 1997. Since 2004, he has been the director of Korean Institute of Lighting Technology. Professor Cho had been the chairman of the International Backlight Standardization Forum from 2005 to 2009. Also, he had been the advisor of the Korean Society of Information Display from 2007 to 2009. Since March 2010 he has been a dean of College of Natural Science at Kwangwoon University, and since March 2011 he has been an executive Secretary of Board of the Trustee at Kwangwoon Foundation.
Professor Cho is engaged in research on External Electrode Fluorescent Lamps for the light source of TFT-LCD Back-Light, Capacitive-Coupled Discharge Flat Panel Fluorescent Lamps for LCD Back-Light, Inverter Power Systems and Driving Technology for the Back-Light of a Large Area LCD TVs, Micro-Discharges and PDP technology, Biomedical-Plasma, Plasma Jet and LED-packaging Technology, LED-backlight Technology, LED-Lighting, etc. He has published numerous papers on the back-light and LCD, etc. in both SCI and Korean Journal. He is contributes to the plasma physics through many research and papers as a professor and dean.