Carbon Nanotube Electronics
from Flat Displays to Radar, Communications, and Satellites

Presenter: David Hsu

High Current Density, Instant-On

Low Voltage, Low Weight
Power-Efficient, High Robustness

High Density Micro-Arrays, No Heat Problem

Carbon Nanotube Electron Emitter (NRL Type I)

Lowest voltage operation

Microsatellite Electric Propulsion
Hall Thruster
FEAs to replace HC
Instant-on
Saves weight (Xe), power

Radar for warning and
electronic warfare

Satellites for communications
and surveillance

Present day ranger systems:
US Army Apache Longbow, US Navy E-2C Hawkeye
("Northrup Grumman Today")

Present day Hall thruster
(courtesy of PPPL)

Ion Trap Mass Spectrometer
"Ion Trap Mass Spectrometer (courtesy of PPPL)"

Tailored X-ray
Source
(# Whitlock, NRL)

RF amplifiers for Radar, Communications,
and Electronic Countermeasures

Miniature Traveling Wave Tube

RF input

DC thermionic (hot) cathode

FEA cold cathode

RF output

Xe gas ion propellant

Satellite systems
("Northrup Grumman Today")

Present day Hall thruster
(courtesy of PPPL)

Ion Trap Array Mass Spectrometer
-R. G. Cooks, Purdue (ONR)

Cylindrical ion traps
(1-5 mm diameter)

Electron injection endcap

FEA electron source

Ion Trap Array Mass Spectrometer
-R. G. Cooks, Purdue (ONR)

Cylindrical ion trap array
Endcap/position addressable array
Detector
Cylindrical ion trap array
Endcap/position addressable array
Detector

Magnetron RF source

Cylindrical ion trap array
Endcap/position addressable array
Detector

Satellite systems
("Northrup Grumman Today")

Satellite systems
("Northrup Grumman Today")

Fluorescence Detector

Fluorescence Sample

Fluorescence X Rays

Primary X Rays
Tailored Spectrum

Field Emission Display
Sunlight-readable
Temperature insensitive

Field X-ray Sources
- Medical diagnostics
- Cargo and equipment inspection

Flat Panel Displays and Portable X-ray Sources

Miniature Chemical Sensors

Ion Trap Mass Spectrometer

Tailored X-ray Spectrometer
(R. Whitlock, NRL)