

# UVC LIGHT SOURCES

P.K. Swain

Heraeus Noblelight America



# Outline



## Hg based lamps



## Arc lamps

- Low pressure lamp
- Medium pressure lamp



## Electrode-less lamp



## Excimer lamp

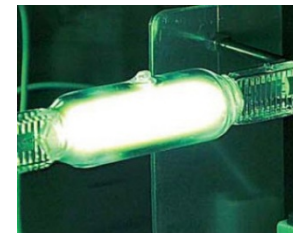


## UVLED



## Lasers and Upconverting Phosphor

# MERCURY-DISCHARGE TYPES



**Hg-low pressure**

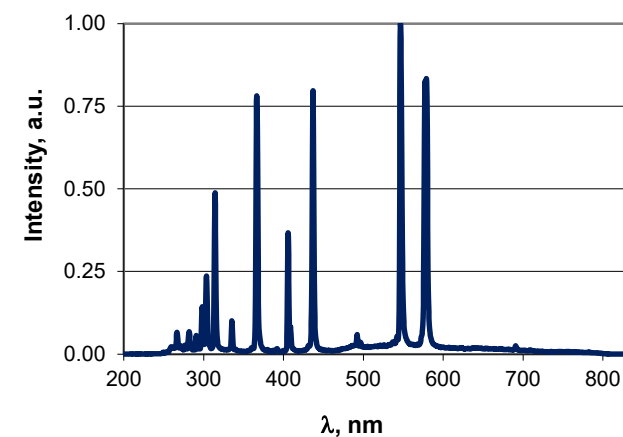
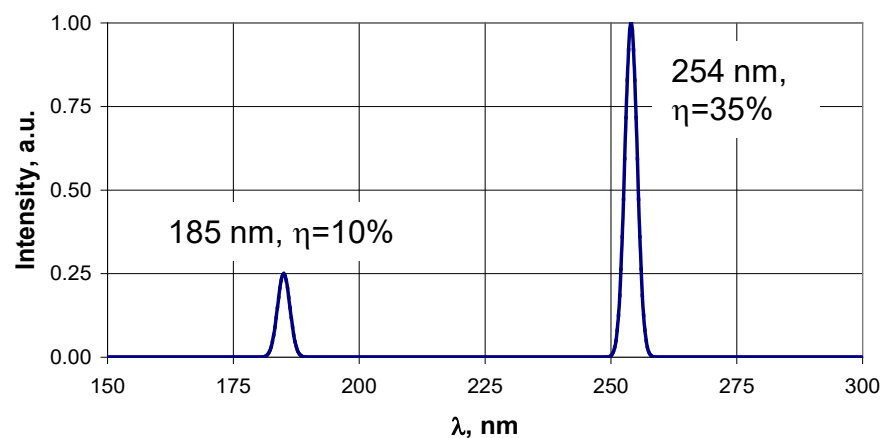
$P_s \sim 0.5 \text{ W/cm}$   
 $T \sim 40^\circ\text{C} \sim 30\text{mW/cm}^2$

**Amalgam-Lamps**

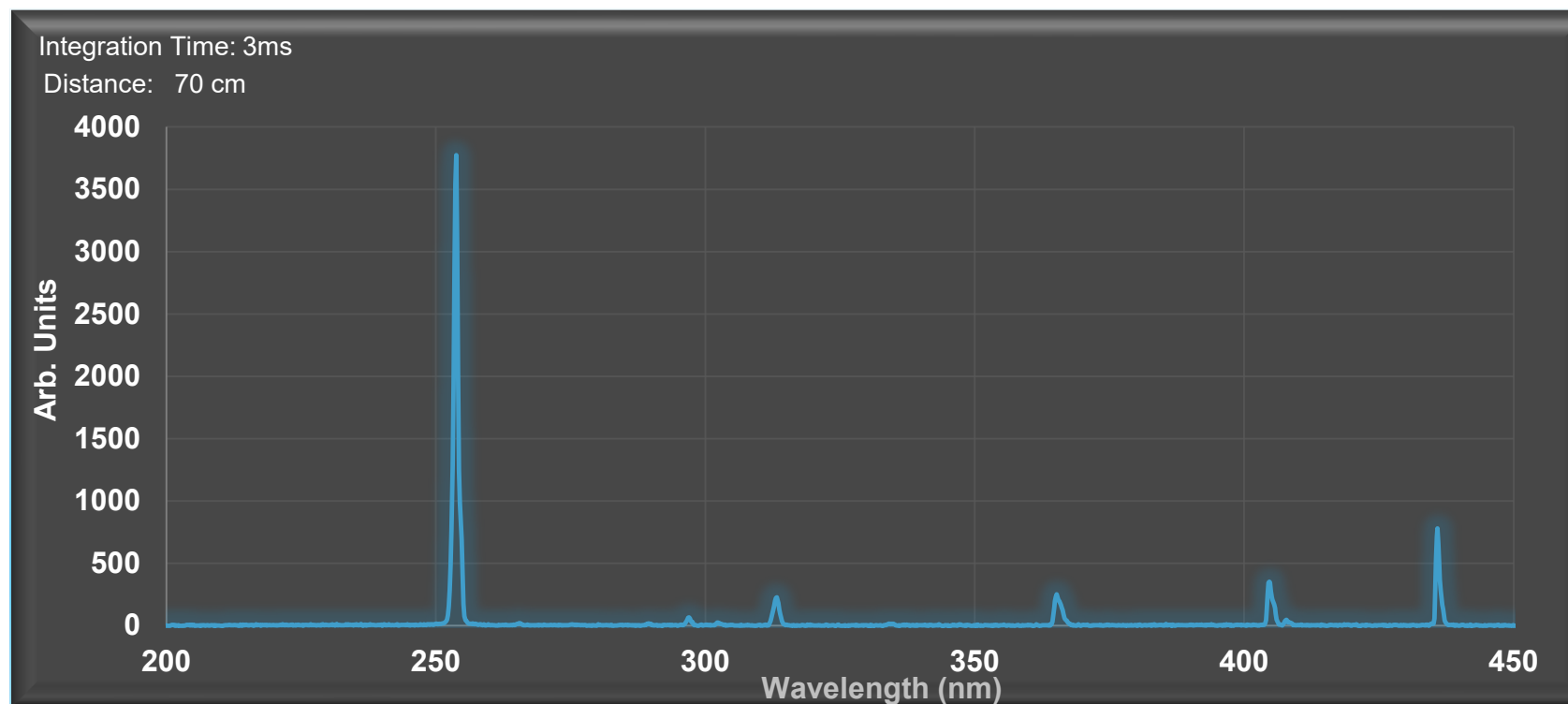
$P_s \sim 4 \text{ W/cm}$   
 $T \sim 120^\circ\text{C} \sim 200\text{mW/cm}^2$

**Medium pressure**

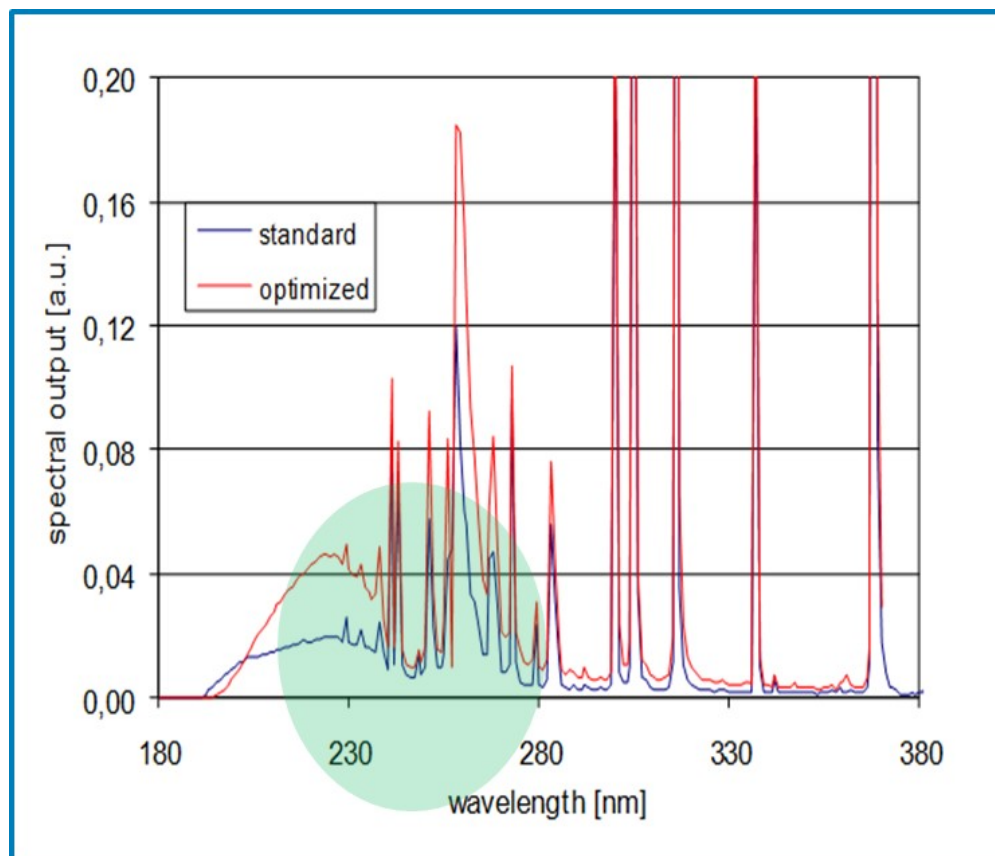
$P_s \sim 100 - 300 \text{ W/cm}$   
 $T \sim 950^\circ\text{C} \sim 4-12\text{W/cm}^2$



# LOW PRESSURE ARC LAMP / AMALGAM LAMP

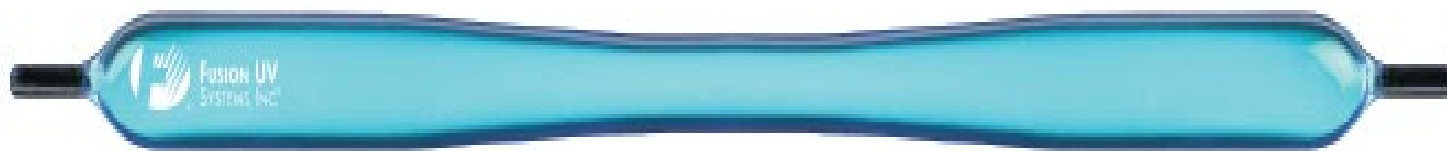
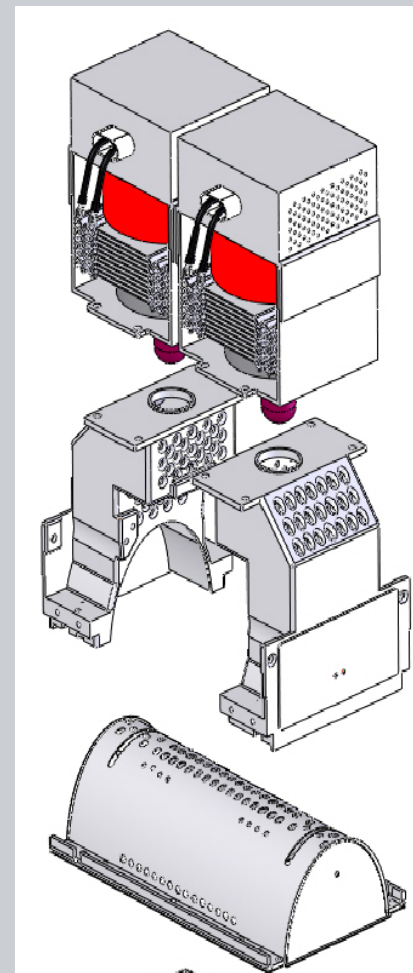
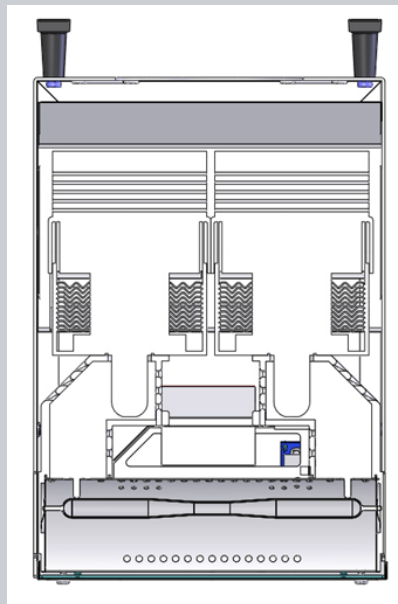


# MEDIUM PRESSURE HG-LAMP

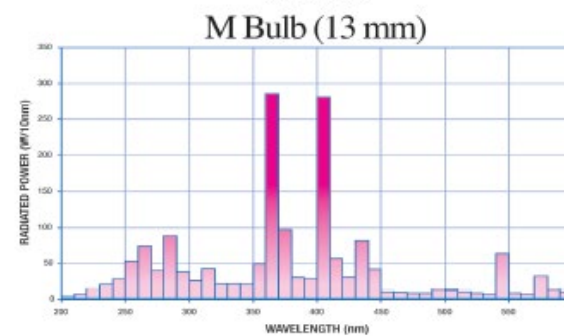
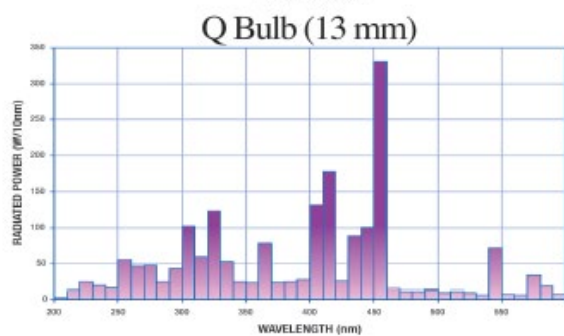
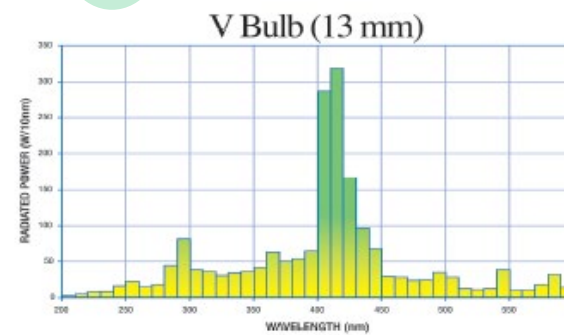
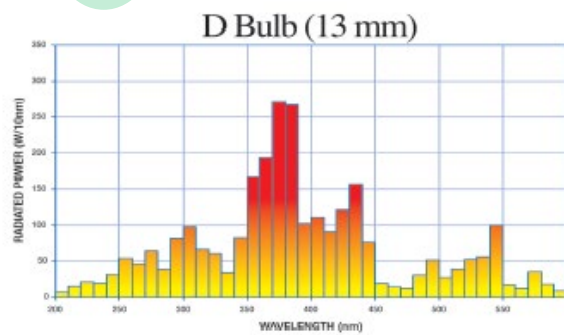
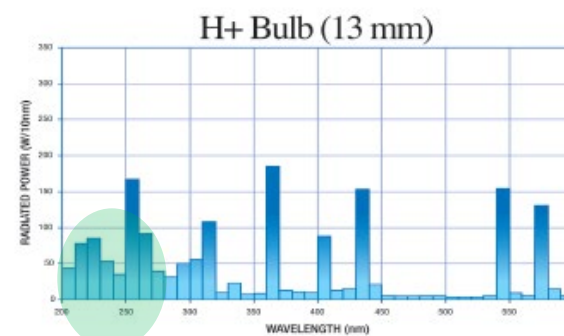
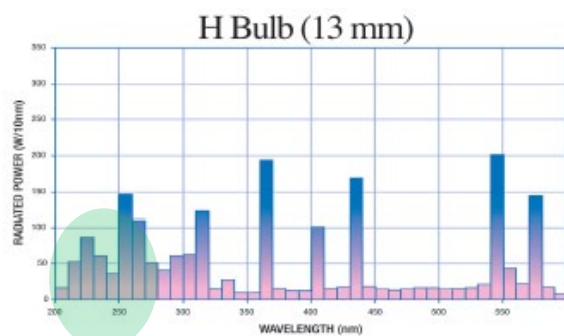




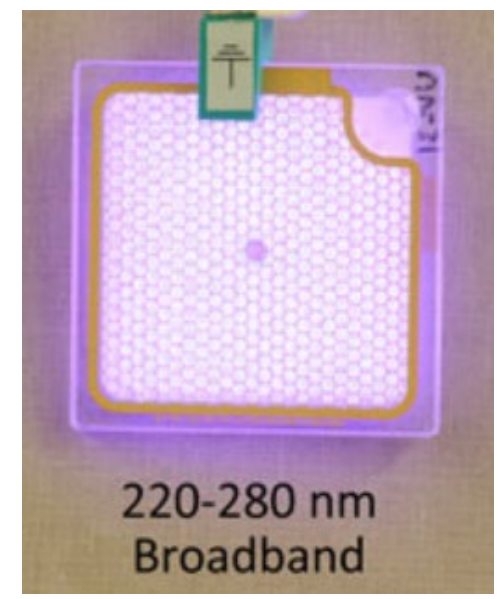
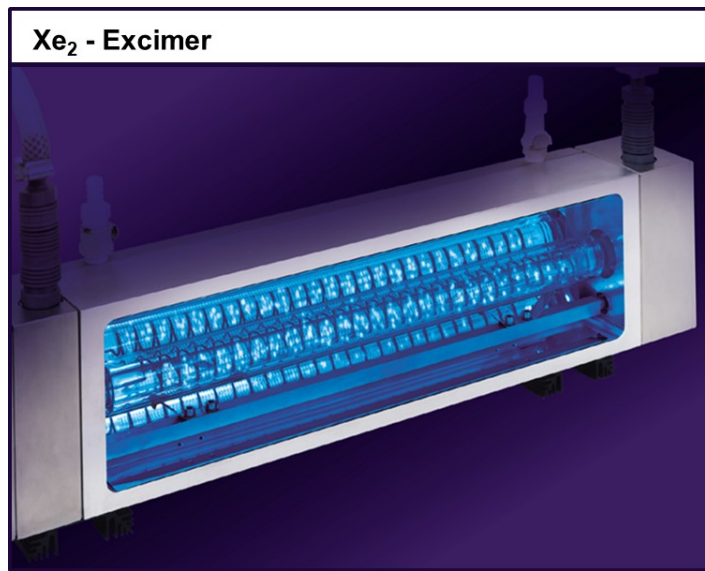
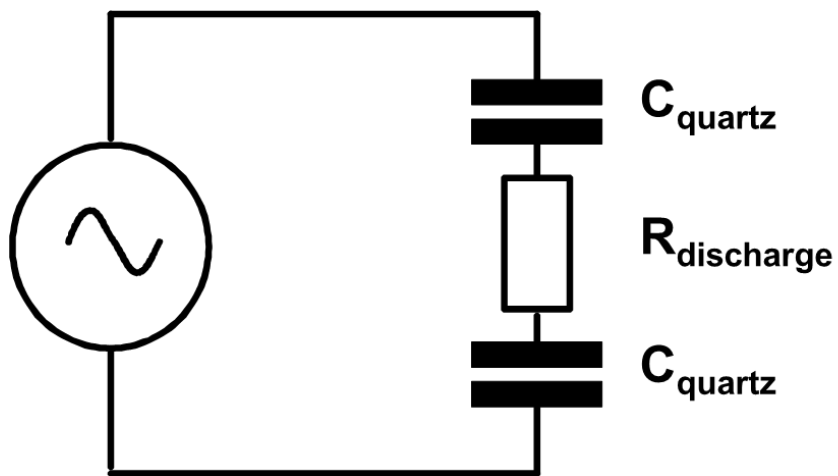
# ELECTRODE-LESS MICROWAVE LAMP SYSTEM



# ELECTRODE-LESS MICROWAVE LAMP BULB SPECTRA

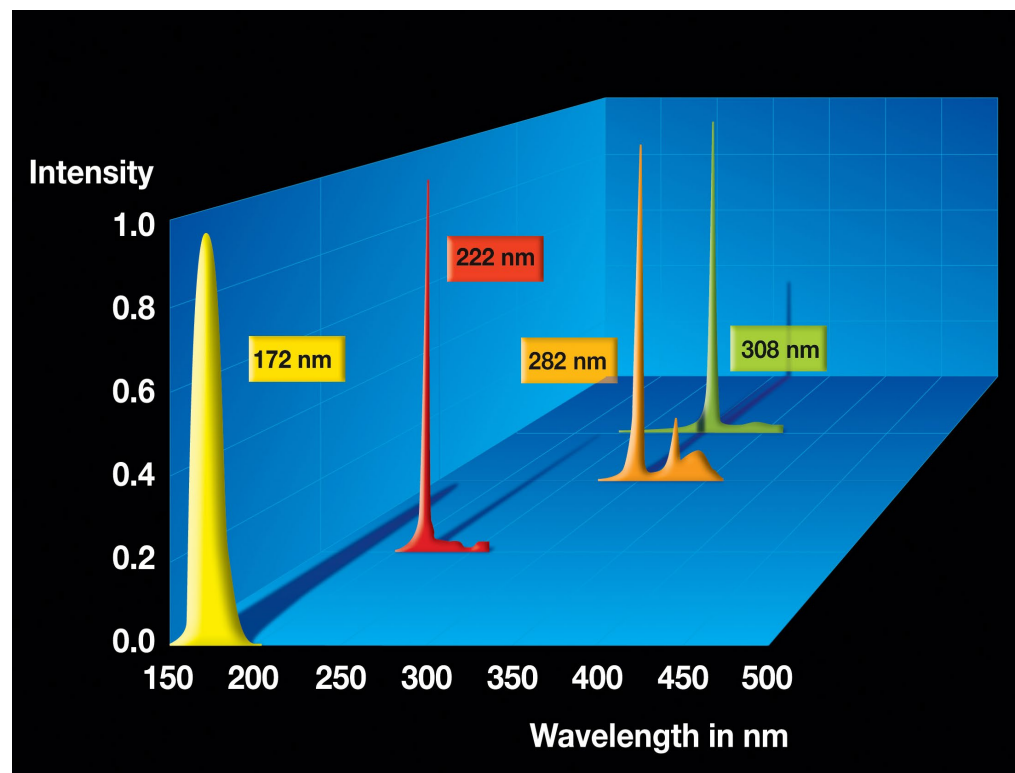


# BARRIER DISCHARGE LAMP (EXCIMER LAMPS)





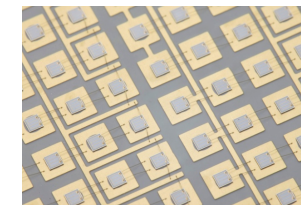
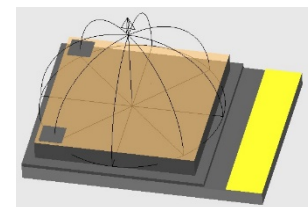
# SPECTRA OF DIFFERENT EXCIMER LAMPS



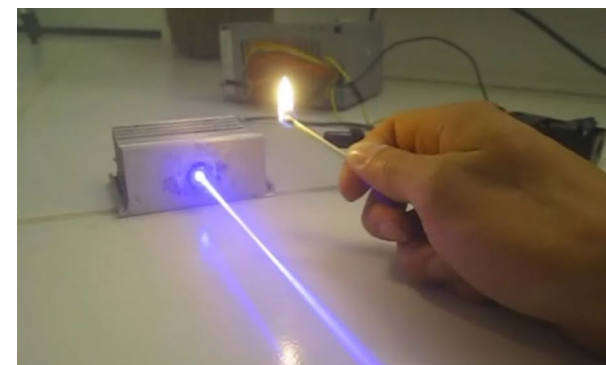
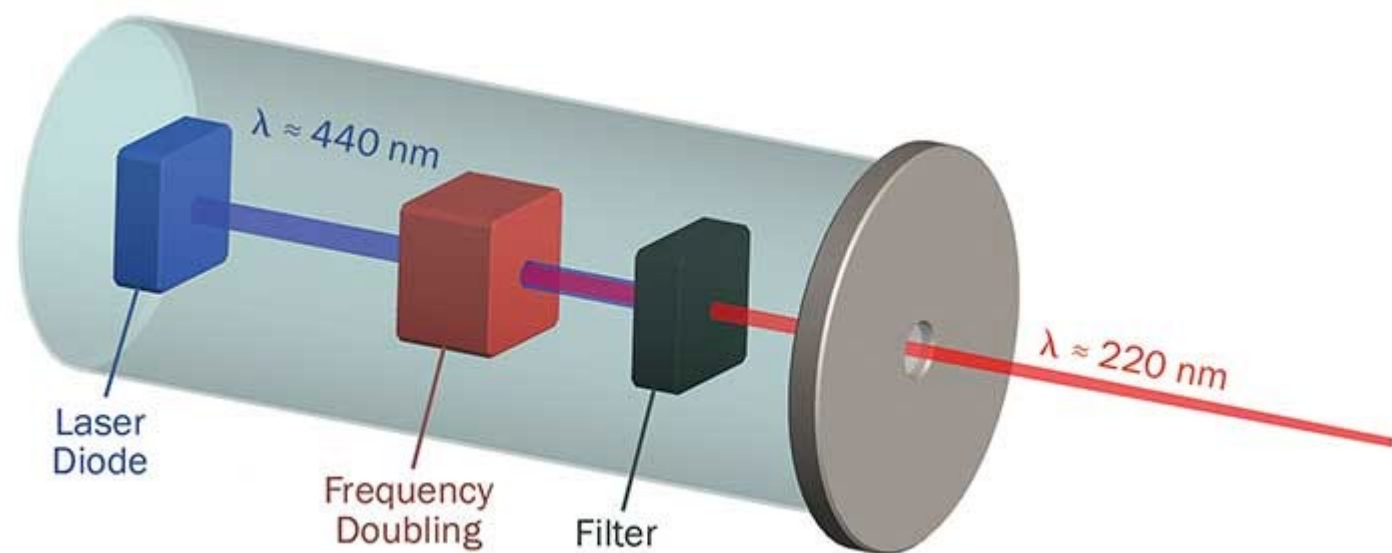
Efficient Excimer Systems			
	System	Wavelength [nm]	Applications
Rare gas-fluorine system	XeF KrF ArF	353 248 193	
Rare gas-chlorine system	XeCl KrCl	308 222	Drying, curing, germicidal
Rare gas-chlorine system	XeBr	282	germicidal
Rare gas system	Xe <sub>2</sub>	172	Surface modification

# COMPARISON OF LED VS. HG BASED LAMPS

Hg based lamps	LED
Contains Hg	No Hg
Delayed ignition	Instant ignition
Plasma discharge	Solid state
High energy consumption	Low energy consumption
IR radiation	No IR radiation
Broad band emission	Monochromatic emission



## DP-UVC (DIODE PUMP) LASERS



## SUMMARY

Lamp Technology	Arc Lamps	Microwave Lamps	Excimer Lamps	UVC LEDs	UVC Lasers
Technology Maturity	High	High	Medium	Low	Low
Cost effectiveness	High	High	Medium	Low	Low
Reliability	Medium	High	Medium	Low	Low
Energy Efficiency	Low	Low	Low	Medium	Medium
Environmental Friendliness	Low	Low	High	High	High

**THANK YOU FOR YOUR ATTENTION !**