



**TREND**  
**FAIR 2009**



# Alkali Metal Photocathodes

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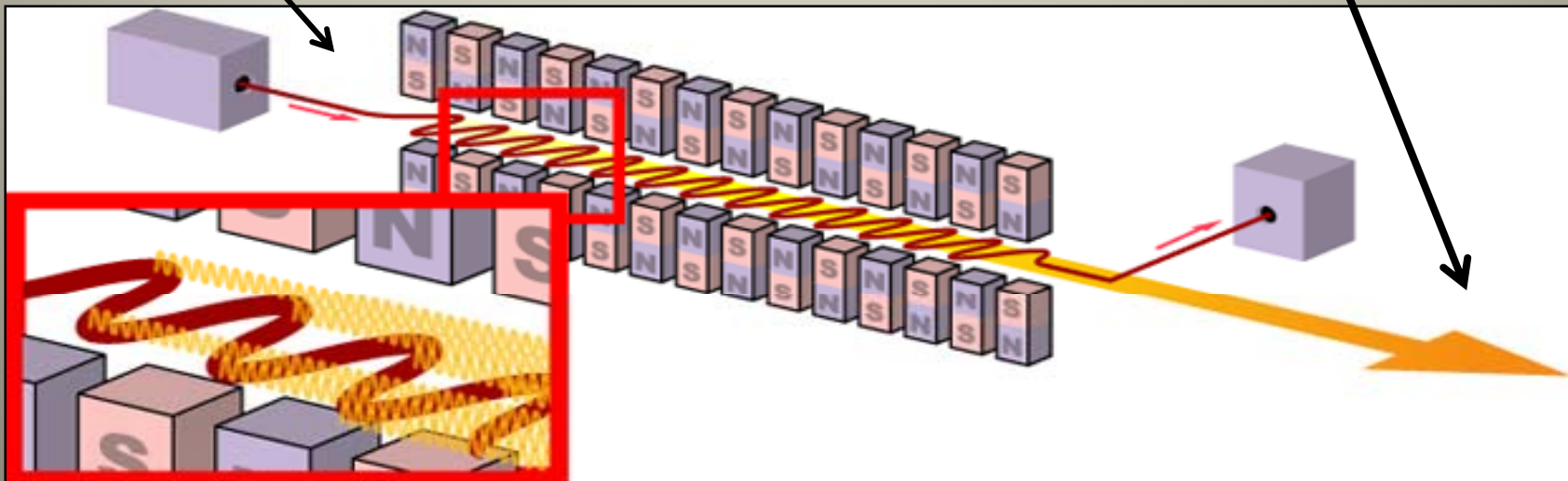


# “Creating Light where there is Darkness”

Goal: Develop laser-switched cathodes that will emit a high current electron beam for Free Electron Lasers.

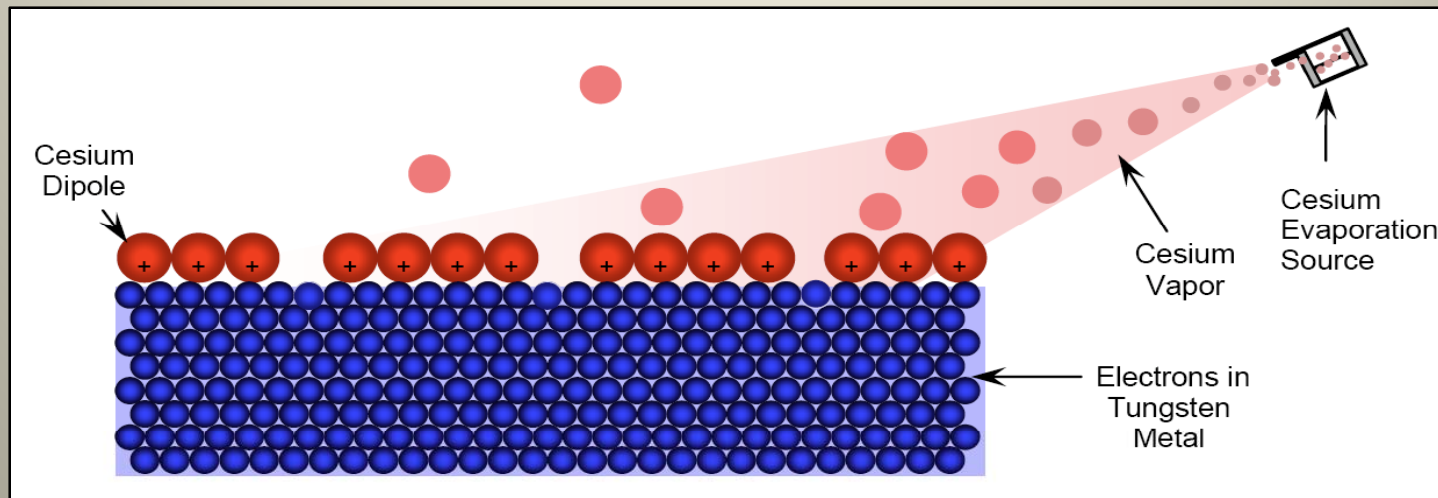
Bright electron beam

Bright laser beam



# Photocathode Surface

- Quantum Efficiency (QE) =  $\frac{\# \text{ Electrons}}{\# \text{ Photons}}$

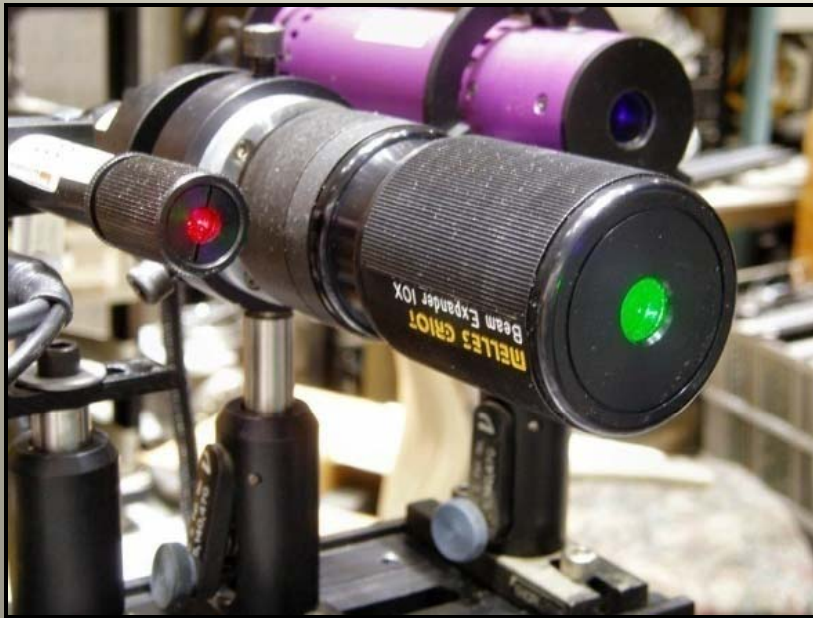


Work Functions (eV)

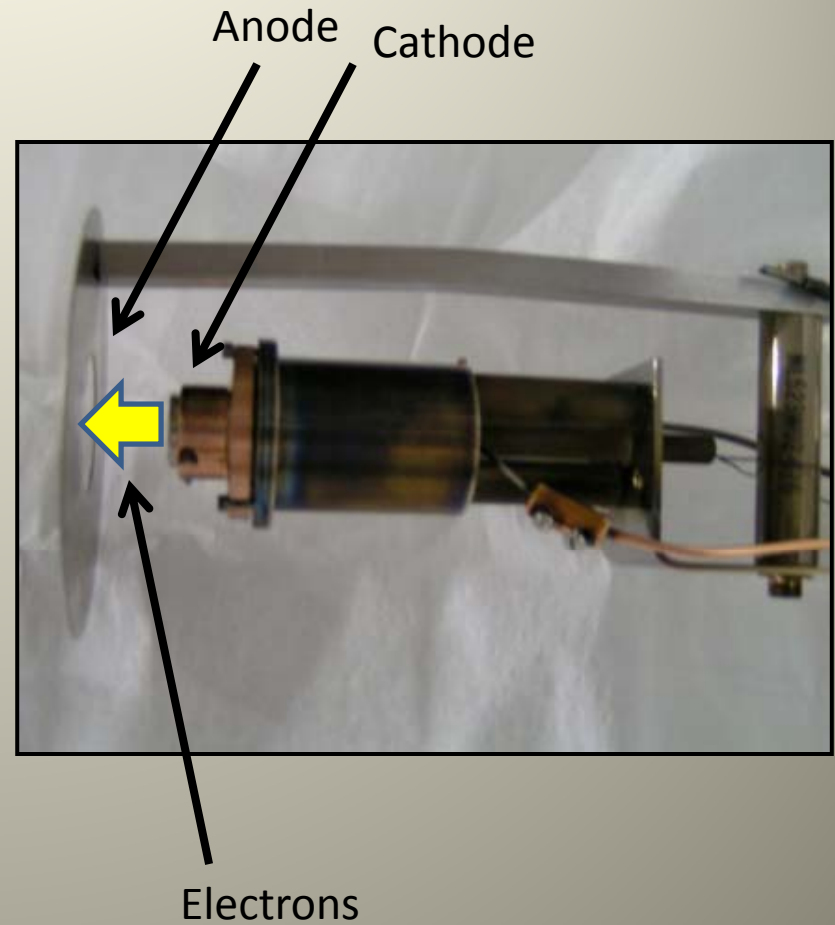
Metal	Bare surface	Cesium (Cs)
Tungsten (W)	4.55	1.7
Silver (Ag)	4.26	1.55

# Techniques

- Ultra high vacuum –  $10^{-9}$  Torr

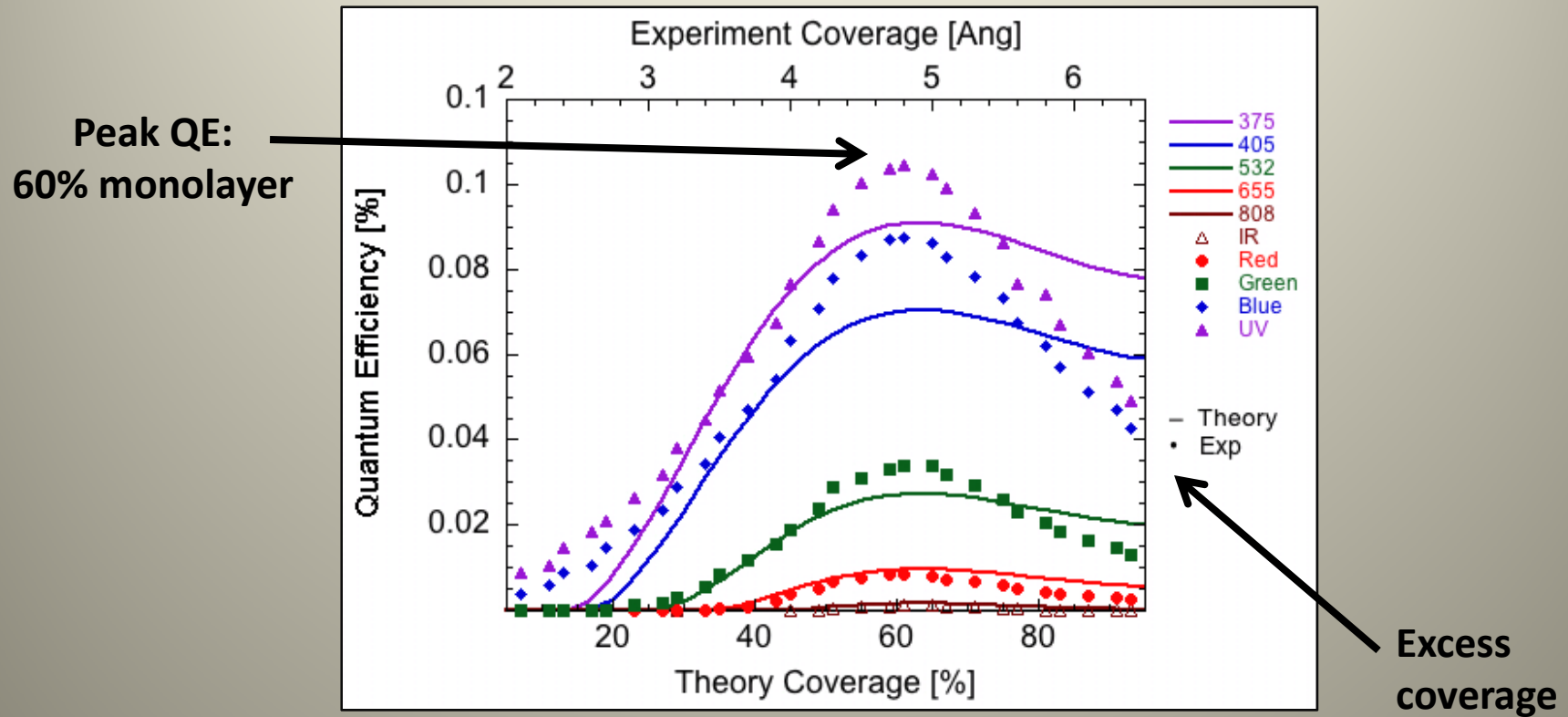


375, 405, 532, 655, 808 nm



# Cs on Tungsten

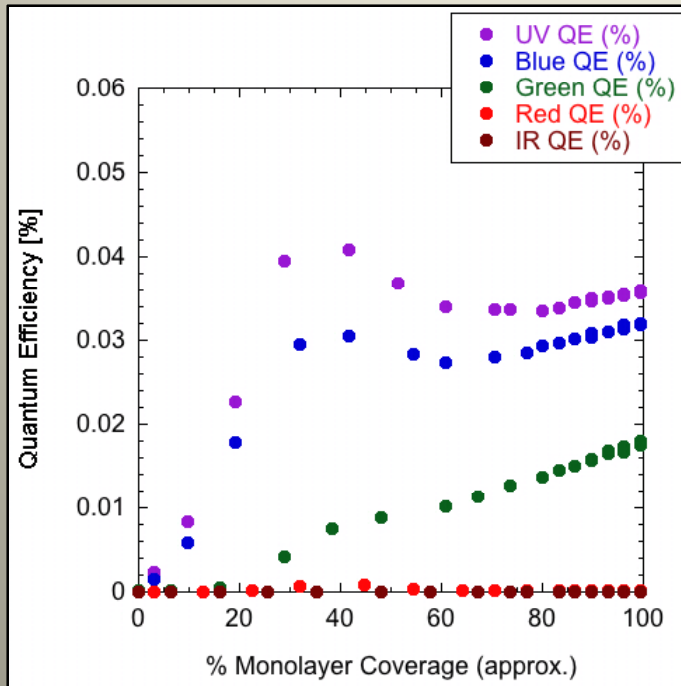
QE vs. Coverage



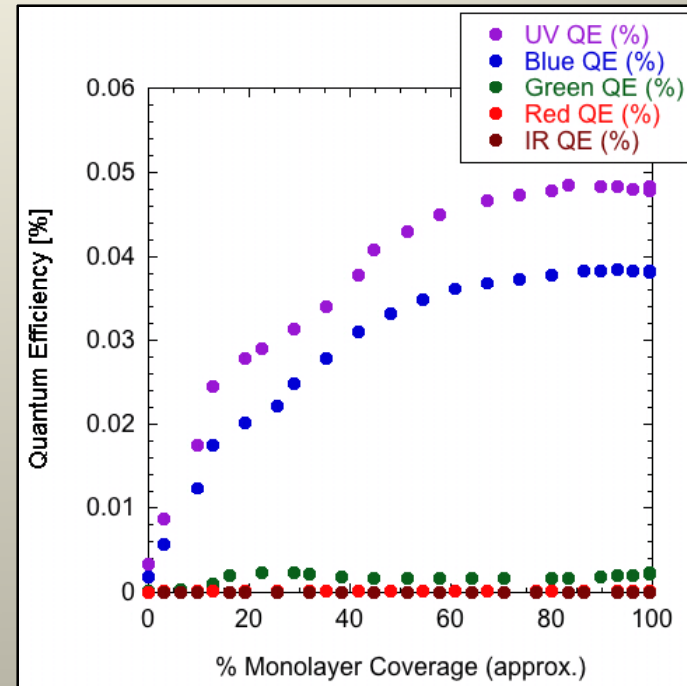


# Recent Results

## K on Tungsten



## Na on Tungsten



- Lower QE% peaks than Cs
- Na and K evaporate slower than Cs
- Create a more robust cathode

# Conclusions and Future Work

- Cesium gives best QE, Sodium and Potassium more robust
- Future: multi alkali coatings
- Knowledge of surface physics will lead to engineering of better photocathodes for Free Electron Lasers.

