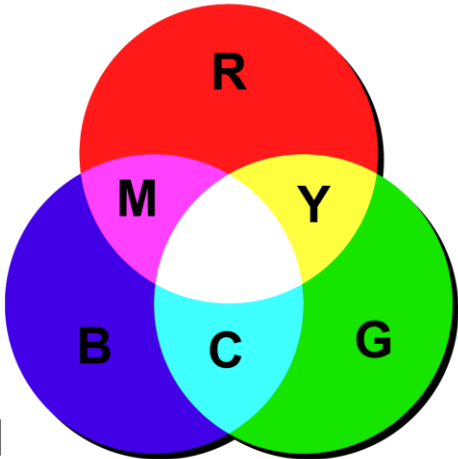


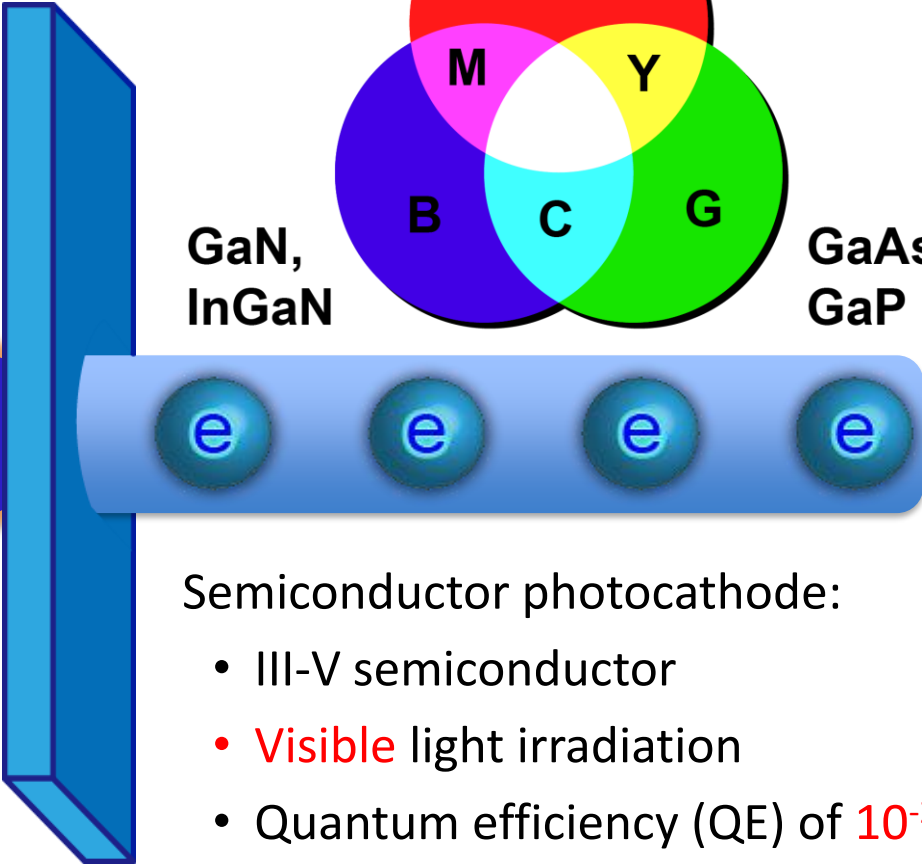
Semiconductor photocathode

AlAs, GaAs, InAs



GaN,
InGaN

GaAsP
GaP



Light irradiation equivalent to band gap energy of semiconductors

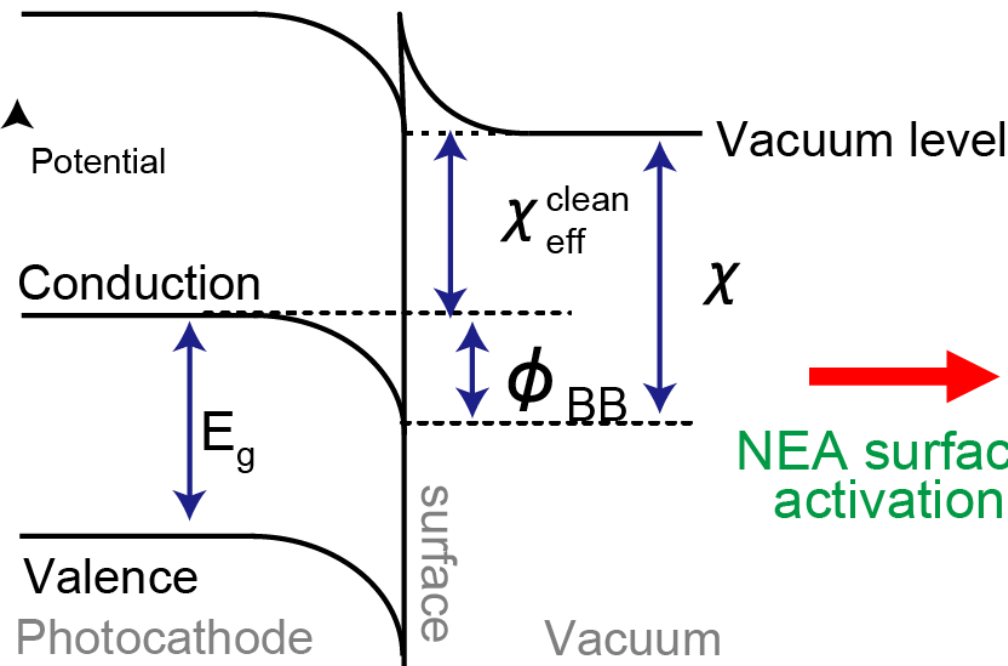
Semiconductor photocathode:

- III-V semiconductor
- **Visible** light irradiation
- Quantum efficiency (QE) of 10^{-2}

Metal photocathode (UV light irradiation)	Material	QE
	LaB6	$9 \cdot 10^{-4}$
	Ba	$7 \cdot 10^{-4}$
	Mg	$1 \cdot 10^{-5}$
	Cu	$2 \cdot 10^{-6}$

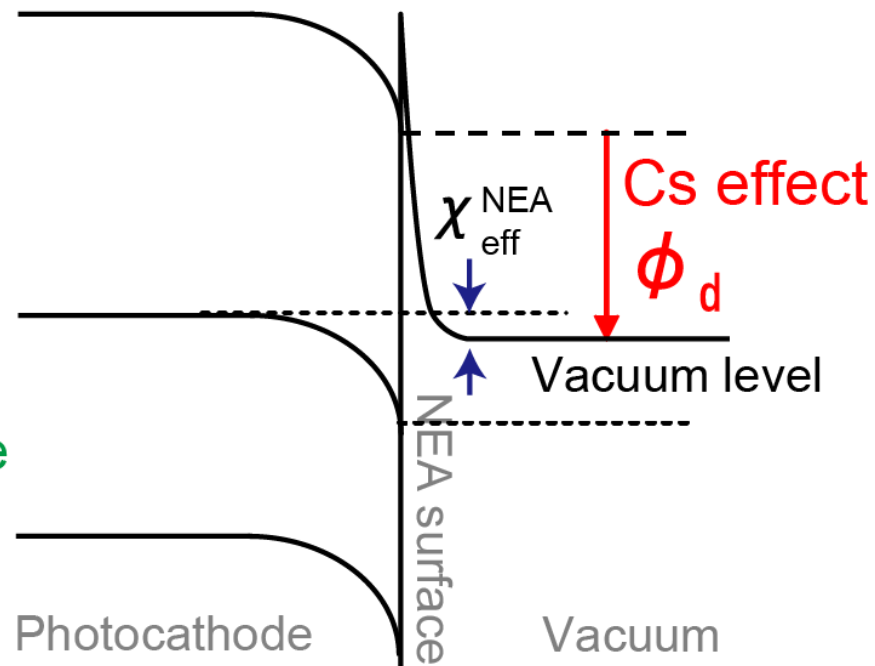
Functional surface on semiconductor photocathode

Clean surface



$$\chi^{\text{clean eff}} = \chi - \phi_{\text{BB}} > 0$$

NEA surface



$$\chi^{\text{NEA eff}} = \chi - \phi_{\text{BB}} - \phi_d < 0$$

NEA surface activation

Photoemission from semiconductor photocathodes

3 step emission

1st step

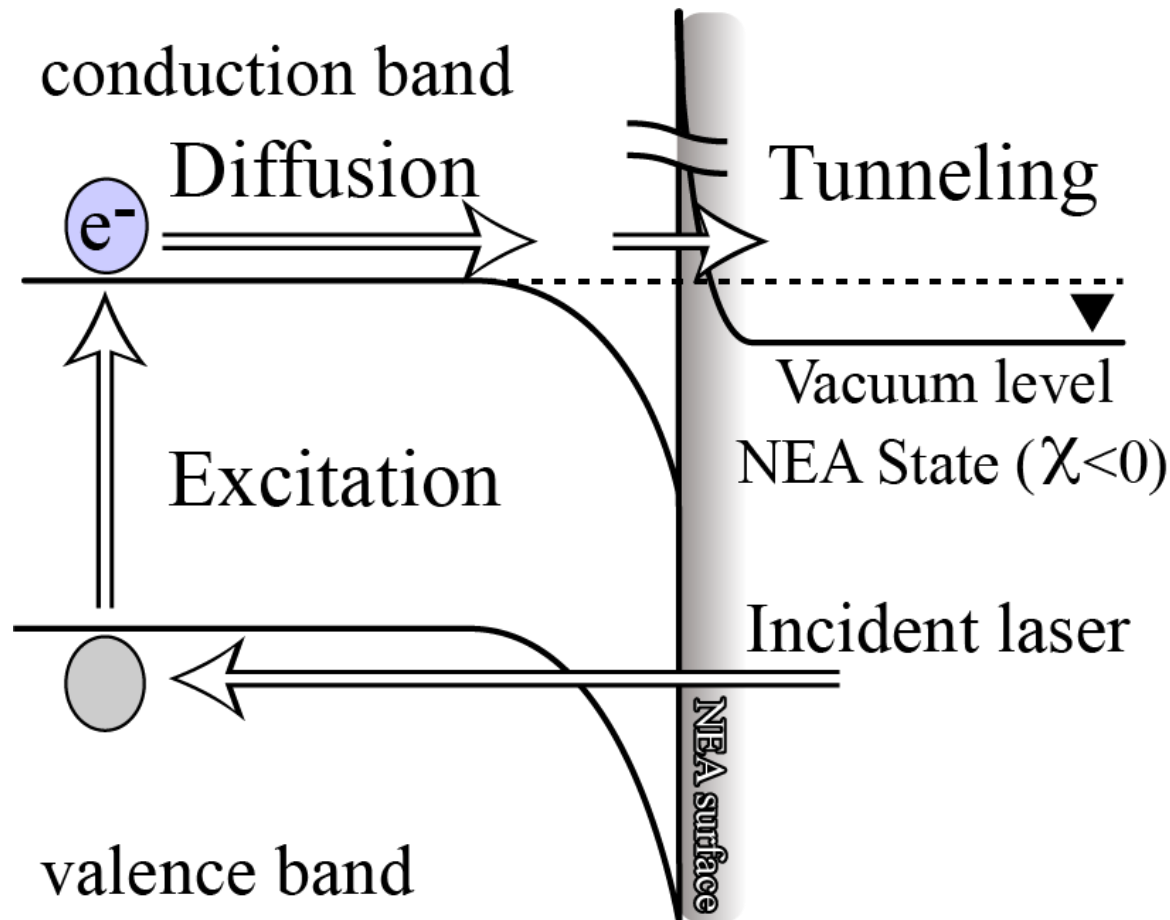
Photo-excitation

2nd step

Diffusion to the surface

3rd step

Tunneling into Vacuum

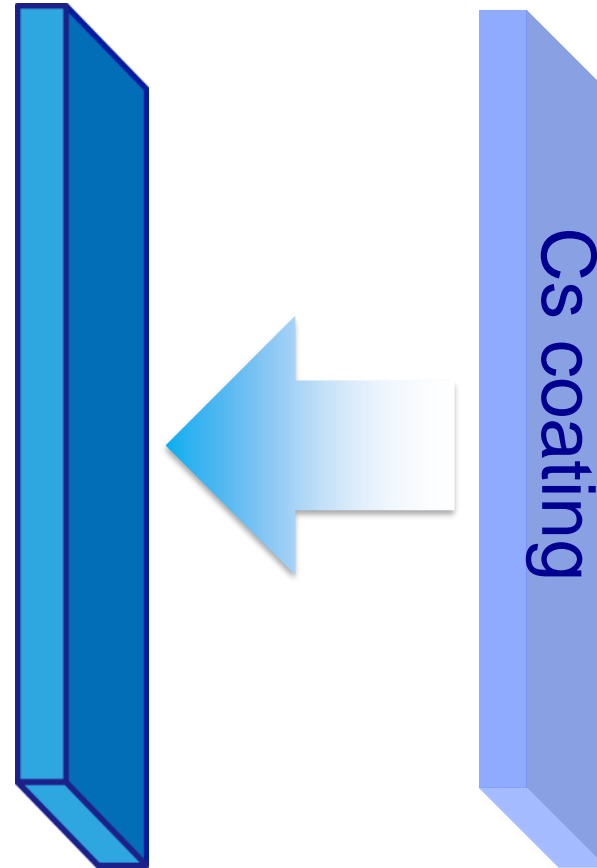


Functional surface on semiconductor photocathode

Key technology > III-V semiconductor and Functional surface

Semiconductor photocathodes
= III-V semiconductors with NEA surface

- Semiconductor
 - ▣
- Surface cleaning
- Cs coating
 - ▣
- NEA - Semiconductor
= photocathode



The surface is activated to the NEA* state.

*Negative Electron Affinity

Renewable the functional surface

Functional surface regenerated by re-deposition of cesium

- Degradation of the surface (Decrease of quantum yield)
Deterioration factor:
Adsorption of residual gas,
Back bombard of ionized residual gas by e- beam
- Surface cleaning and Cs re-coating
- Recovery of surface function

