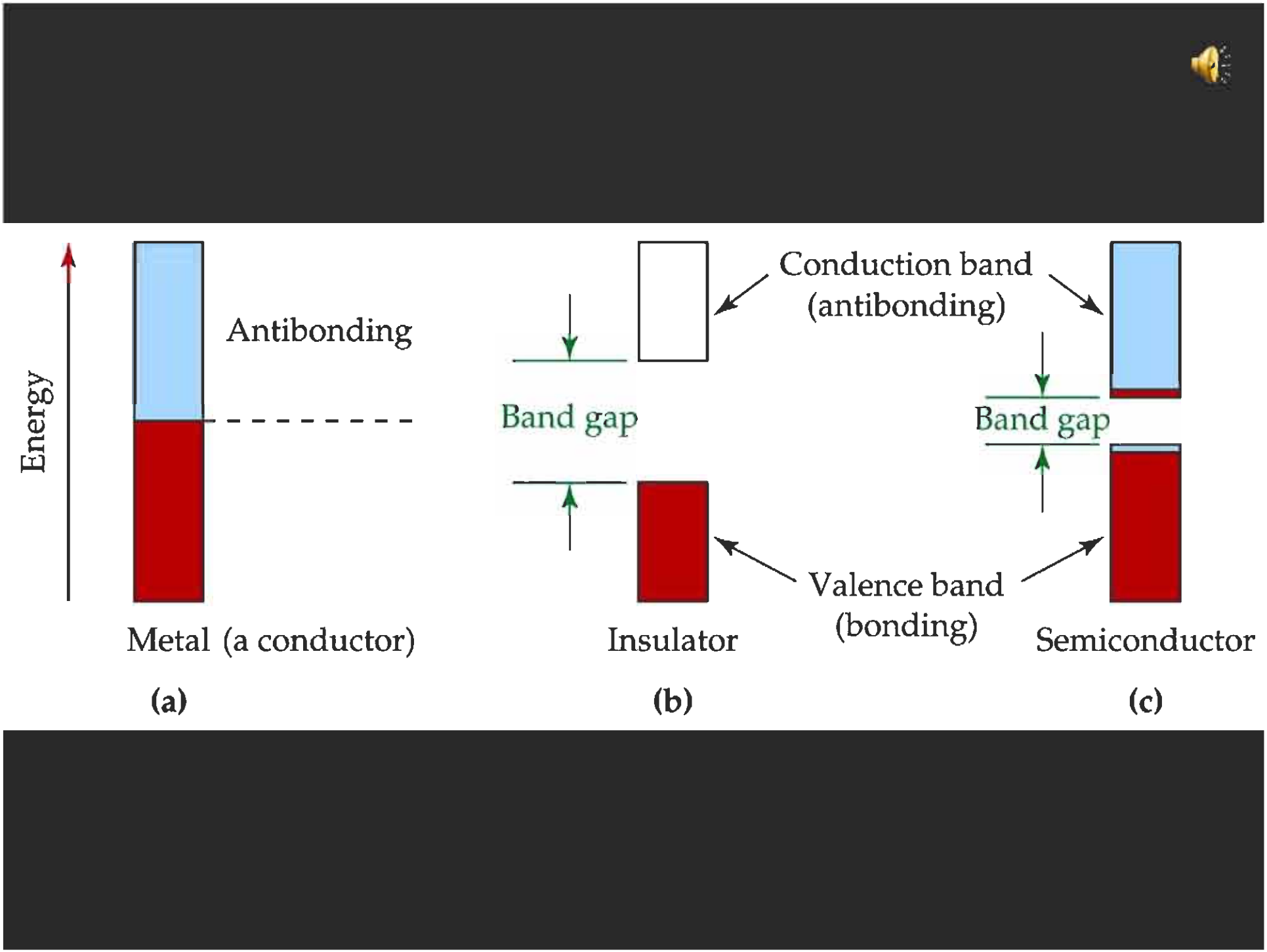
Welcome to 3.091

Lecture 14

October 13, 2004


Energy
Antibonding
Metal (a conductor)
(a)
Conduction band
(antibonding)
Band gap
Valence band
(bonding)
Insulator
(b)
Band gap
Semiconductor
(c)

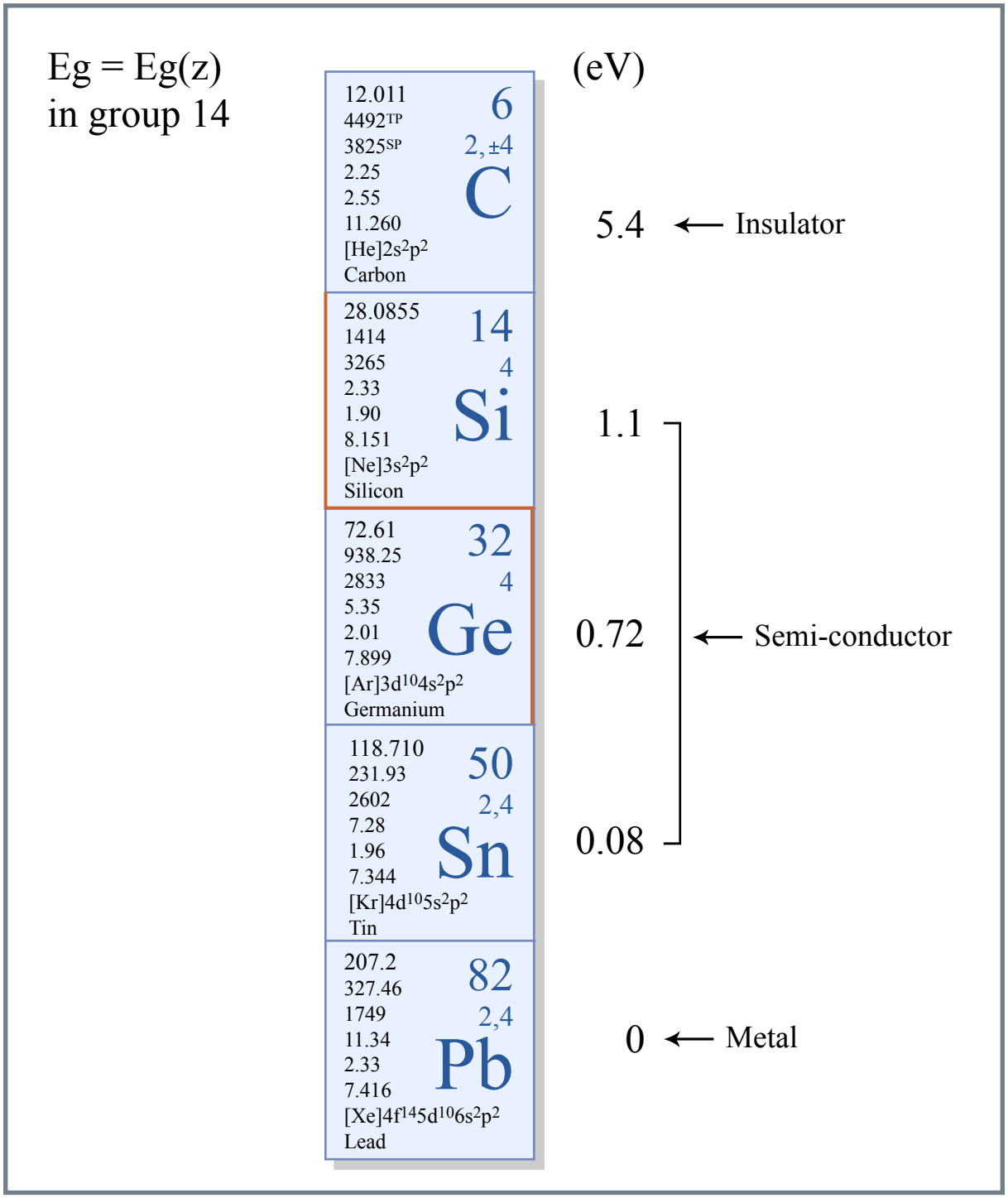
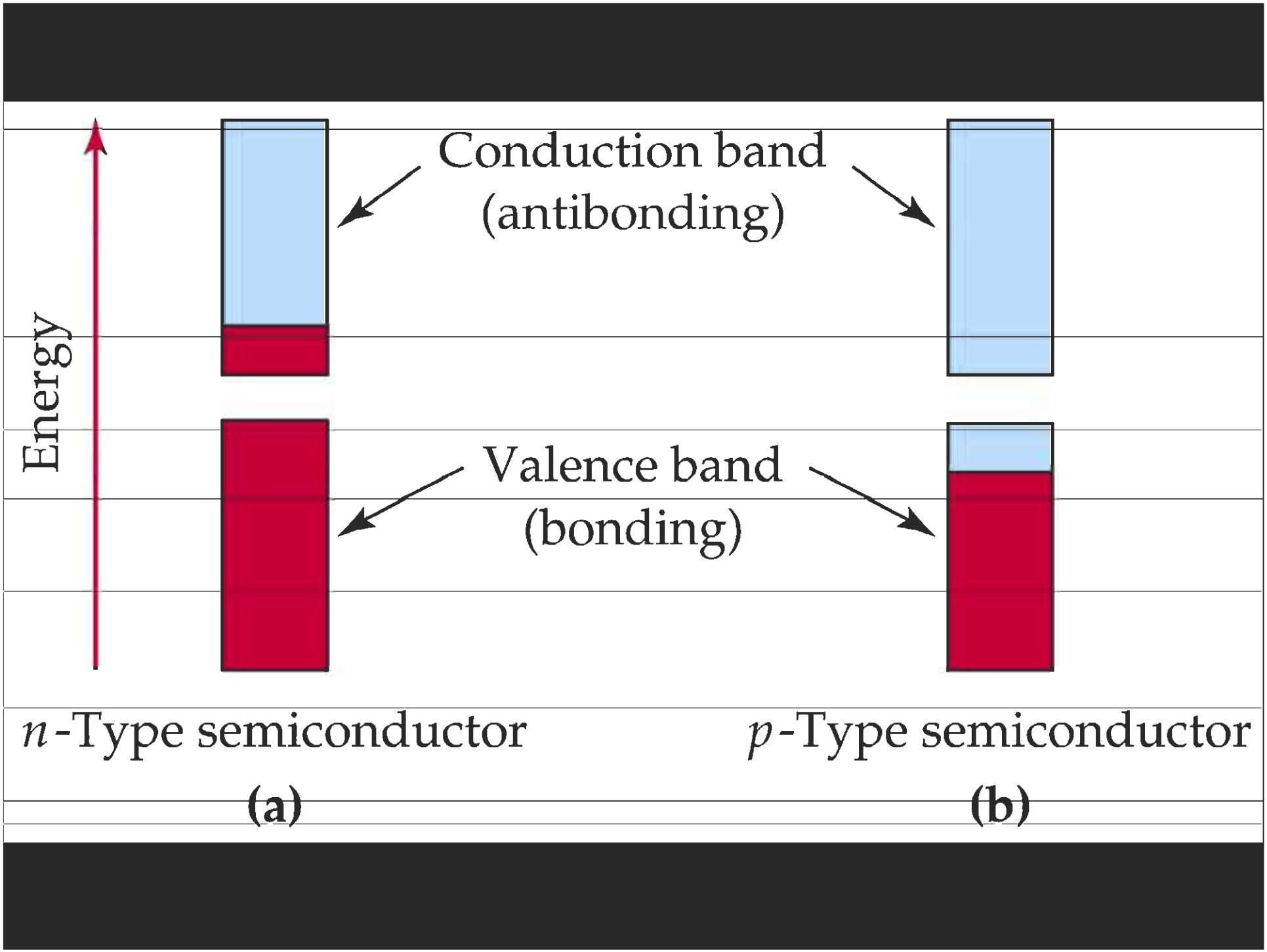


Figure by MIT OCW.


Conduction band
(antibonding)
Energy
Valence band
(bonding)
n-Type semiconductor
p-Type semiconductor
(a)
(b)

Compound Semiconductors

band gap energies, E_g (eV)

inc ΔX

inc. bond strength

inc. E_g

Group 14		III-V			
C	5.4	AlN	6.3	GaN 3.2	InN 2.1
Si	1.1	AlP	3.0	GaP 2.25	InP 1.27
Ge	0.72	AlAs	2.3	GaAs 1.34	InAs 0.33
Sn	0.08	AlSb	1.52	GaSb 0.70	InSb 0.18

$\lambda = 7 \times 10^{-6}$ m IR

⇒ night vision

II-VI			
CdS	2.45	ZnO	3.3
CdSe	1.47		
CdTe	1.45		

$\lambda = 5 \times 10^{-7}$ m visible

⇒ light meter

Compound semiconductors in traffic

red: $Al_{0.5}Ga_{0.5}As$

$E_g = 1.97$ eV $\lambda = 630$ nm

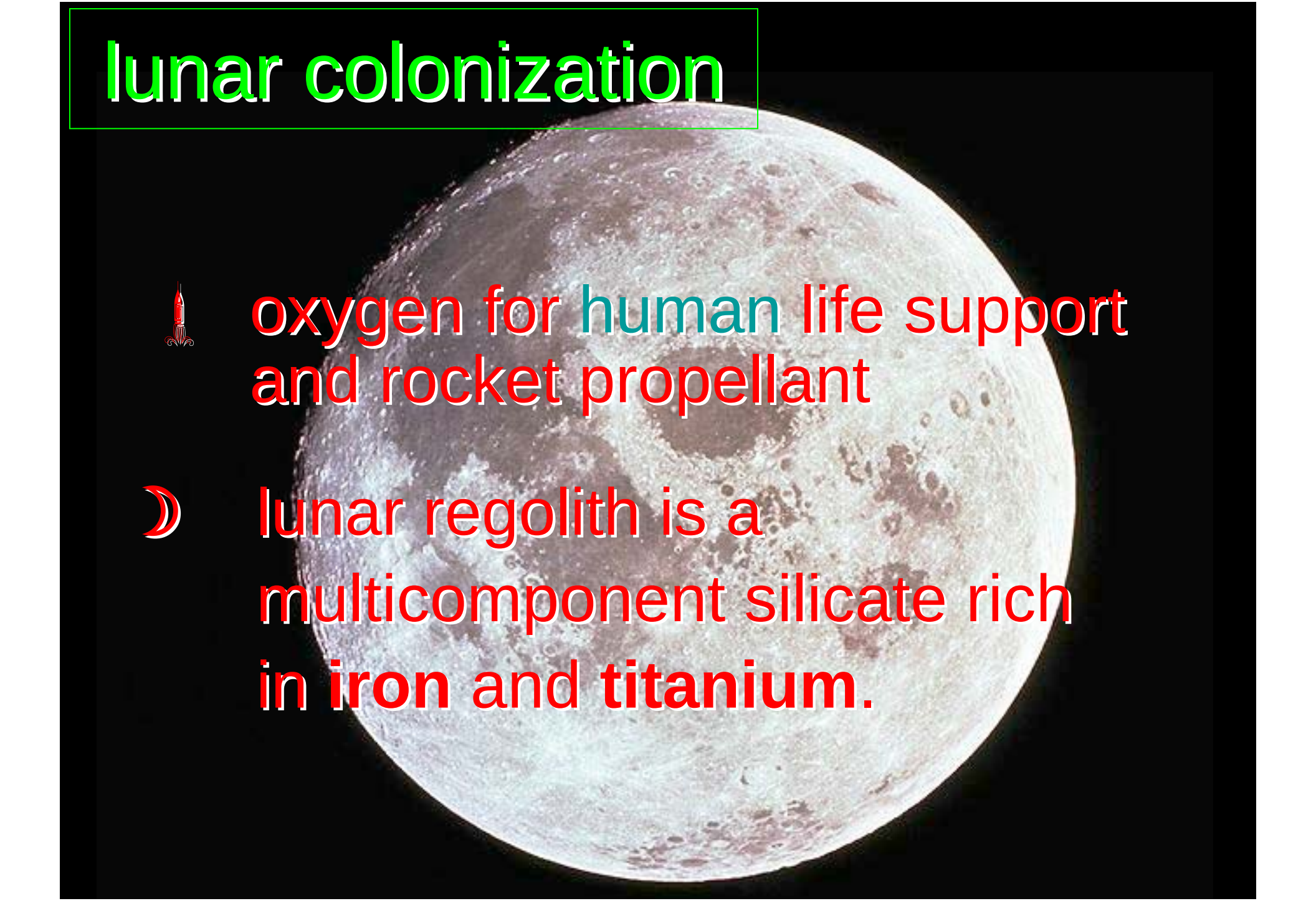
yellow: GaInN

$E_g = 2.14$ eV $\lambda = 580$ nm

blue: $Ga_{0.95}In_{0.05}N$

$E_g = 2.76$ eV $\lambda = 450$ nm

lunar colonization



- oxygen for human life support and rocket propellant
- lunar regolith is a multicomponent silicate rich in **iron** and **titanium**.