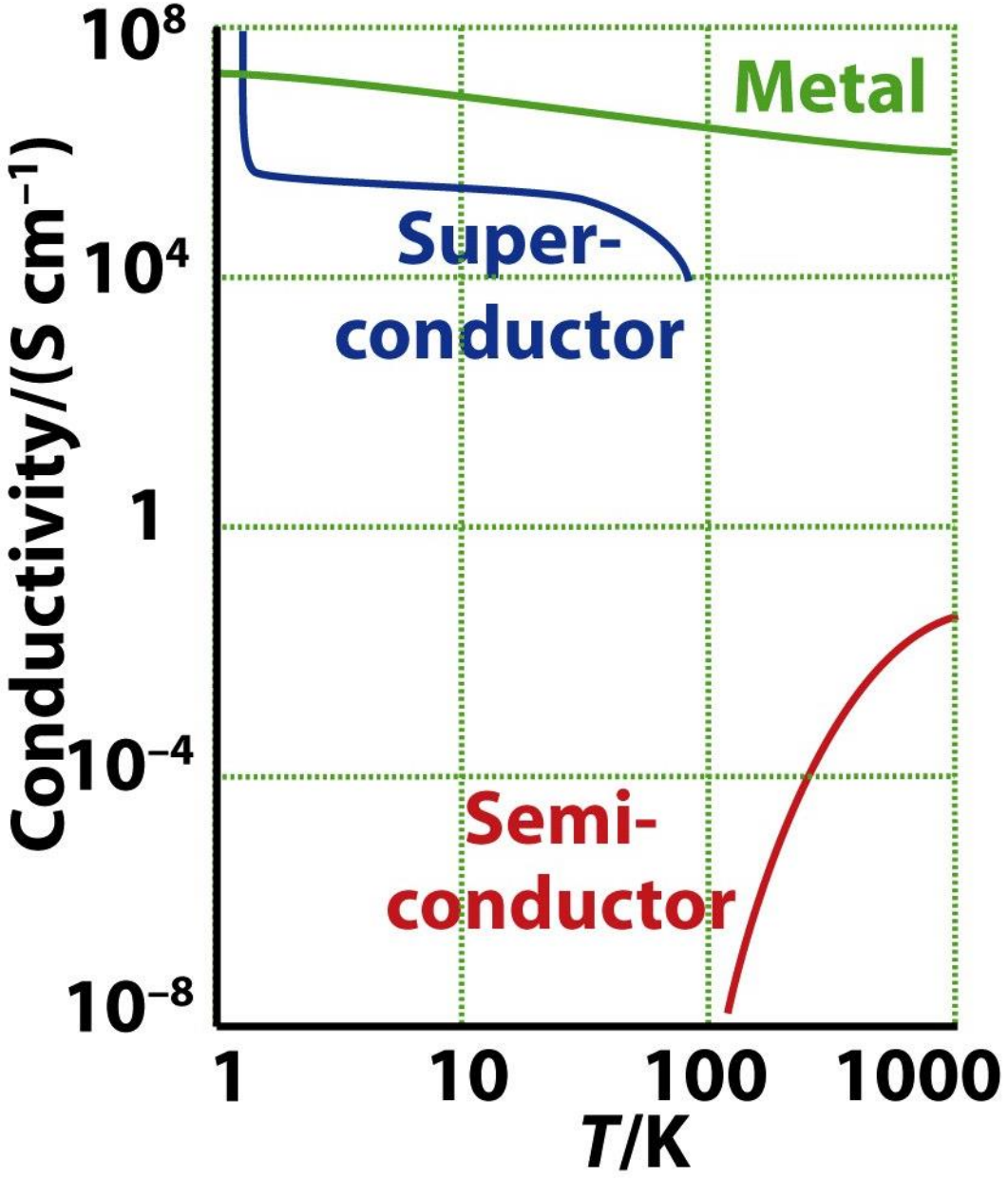
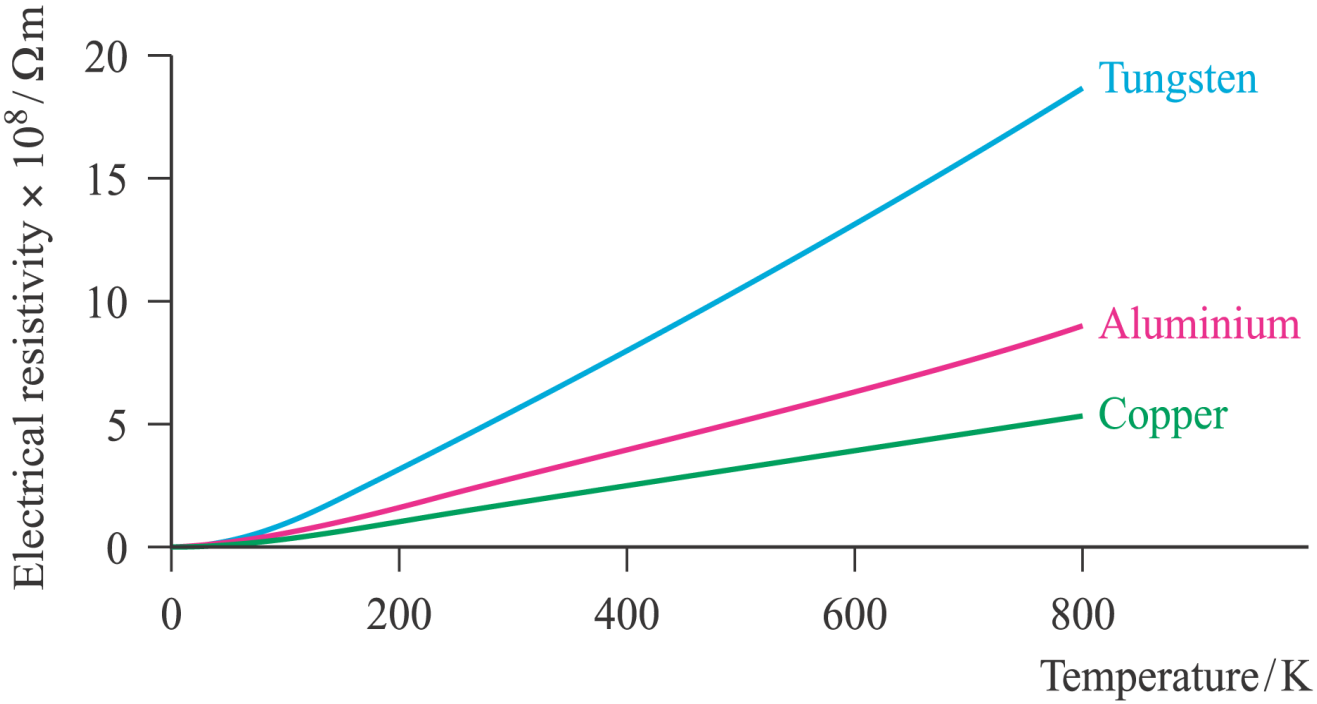
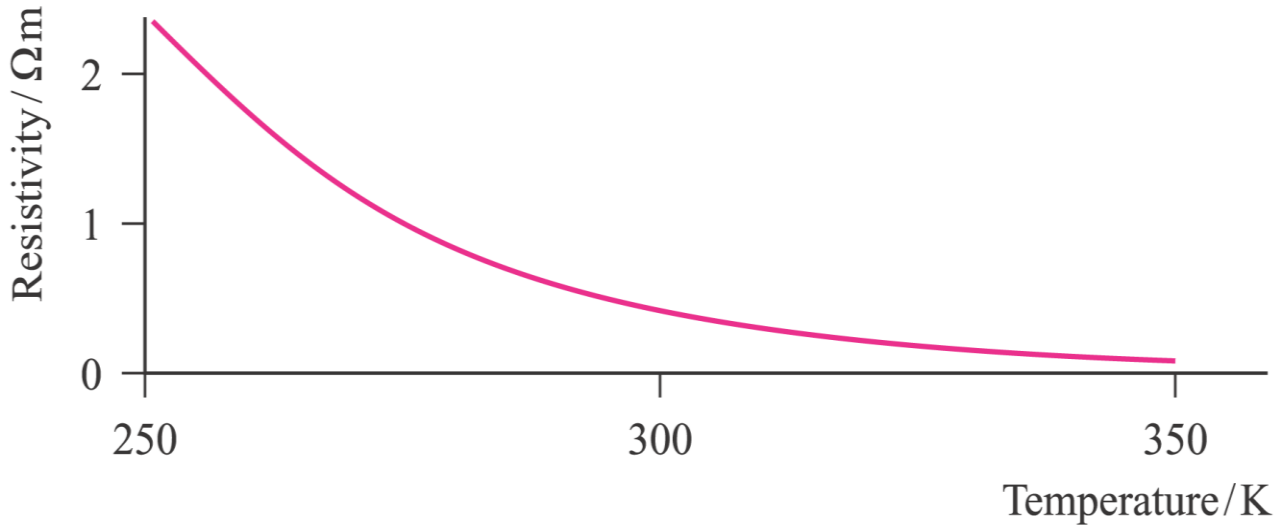

Conductivity/(S cm⁻¹)
10⁸
10⁴
1
10⁻⁴
10⁻⁸
Metal
Super-
conductor
Semi-
conductor
1
10
100
1000
T/K

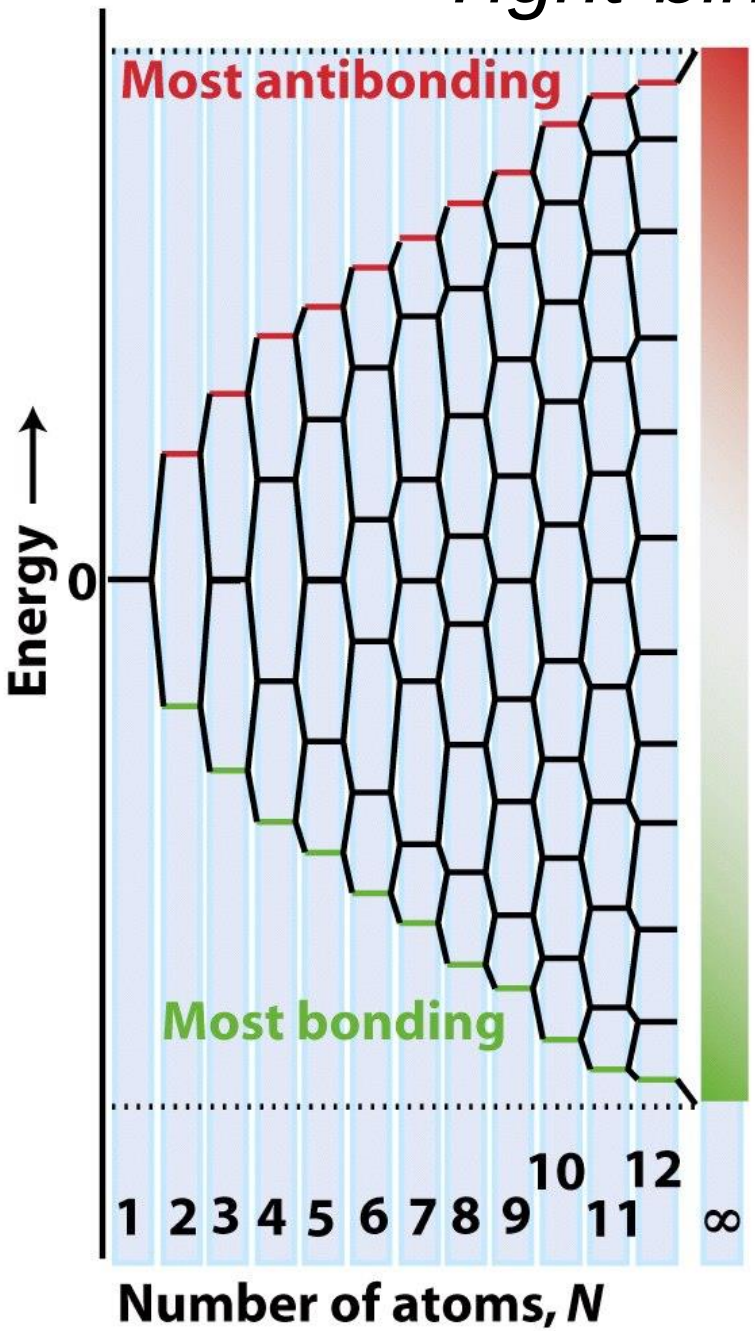
Resistività di alcuni metalli in funzione della temperatura



Resistività del semiconduttore Ge in funzione della temperatura



Tight-binding approximation

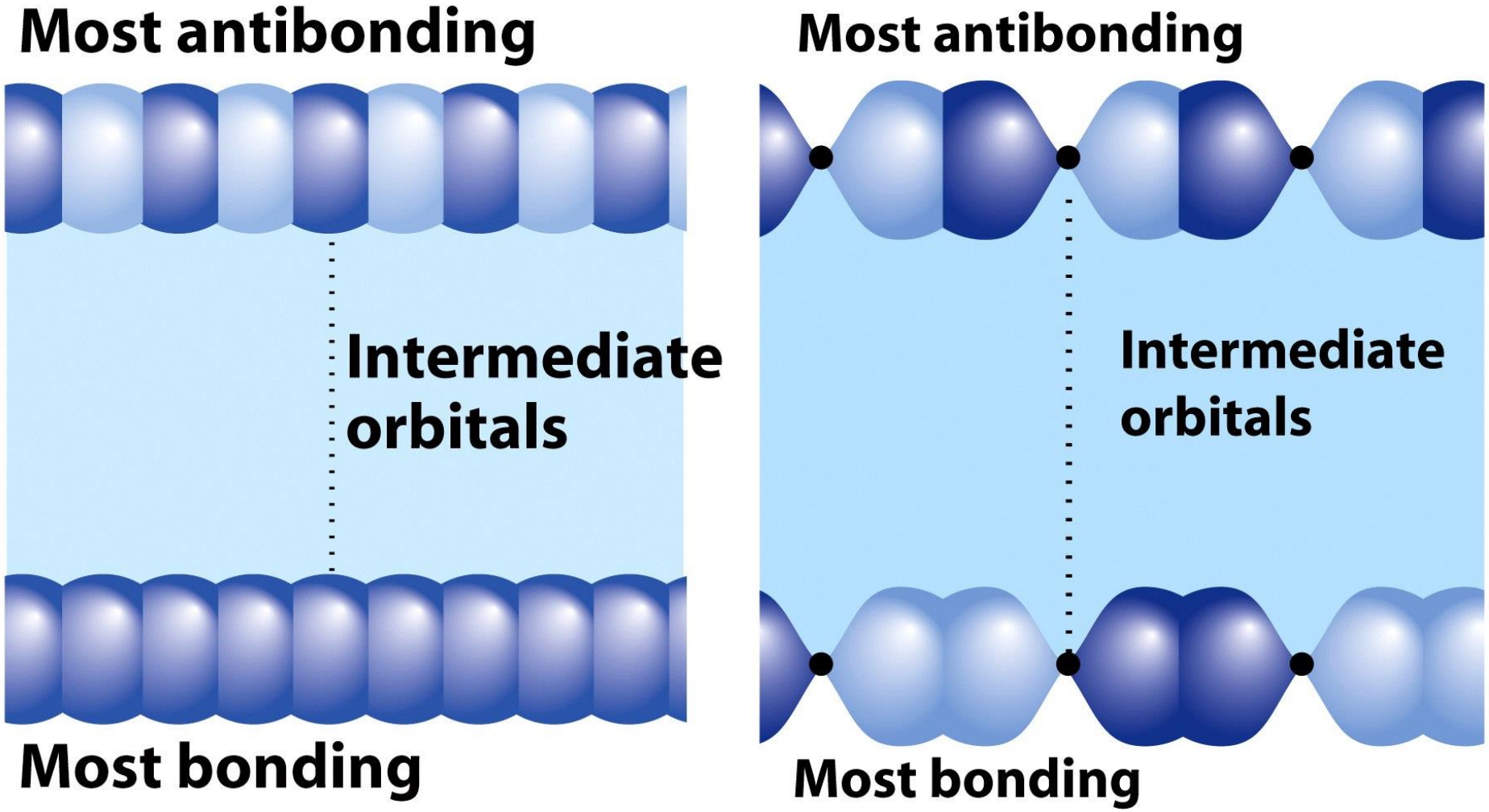


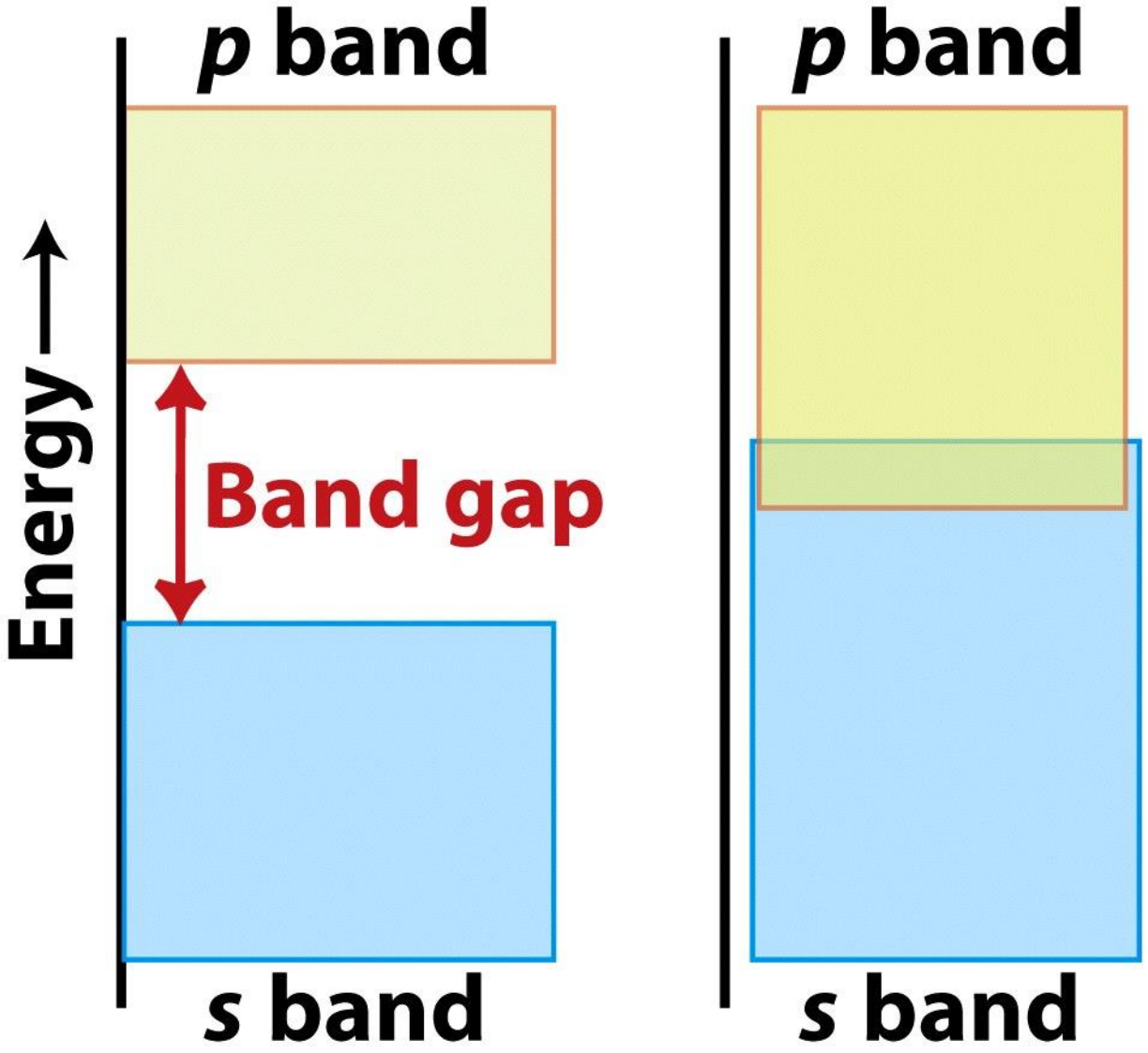
L'ampiezza complessiva della banda rimane finita anche se N si approssima all'infinito

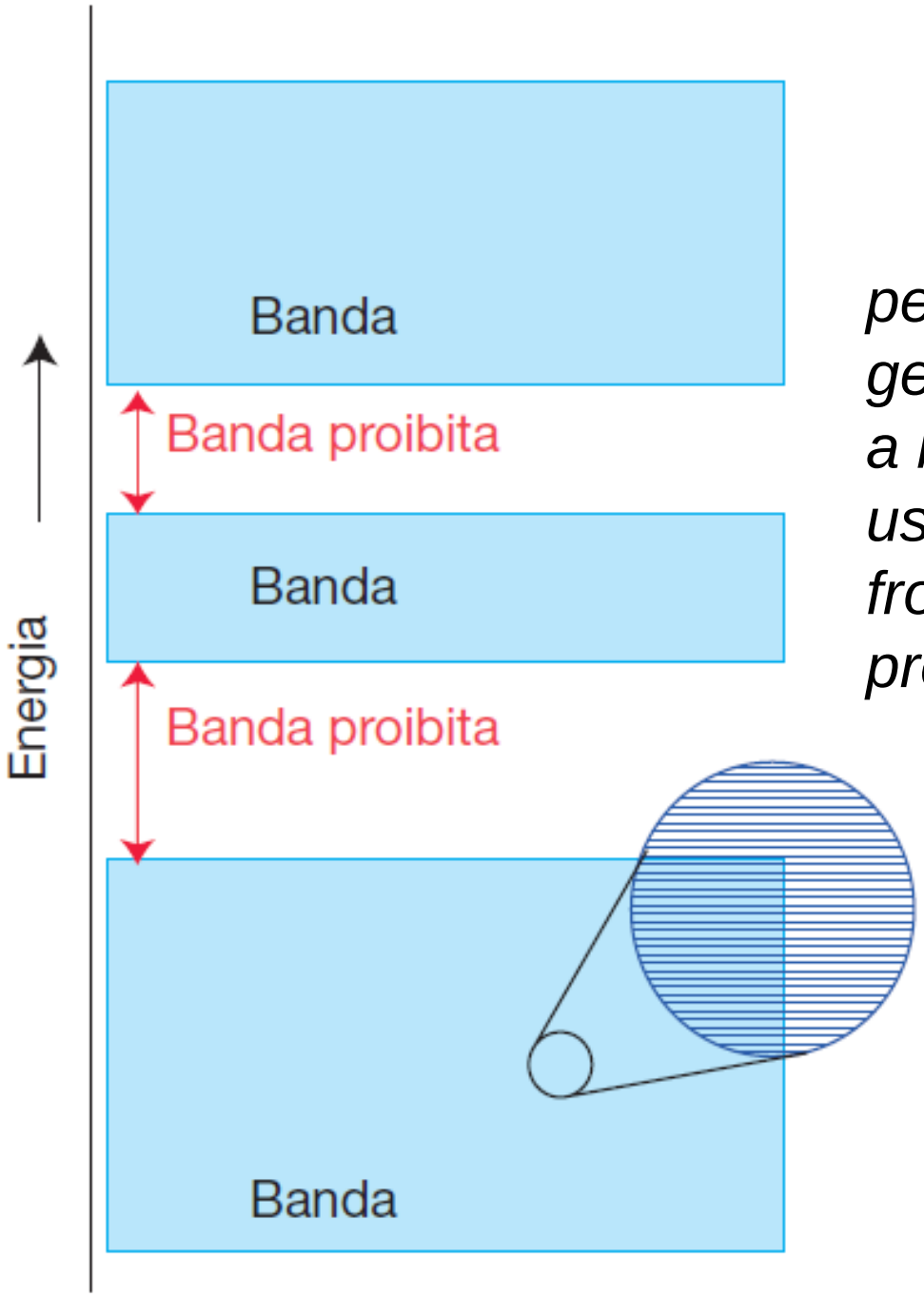
Maggiore è il grado di sovrapposizione tra orbitali atomici adiacenti e più grande è l'ampiezza della banda

Banda s

Banda p



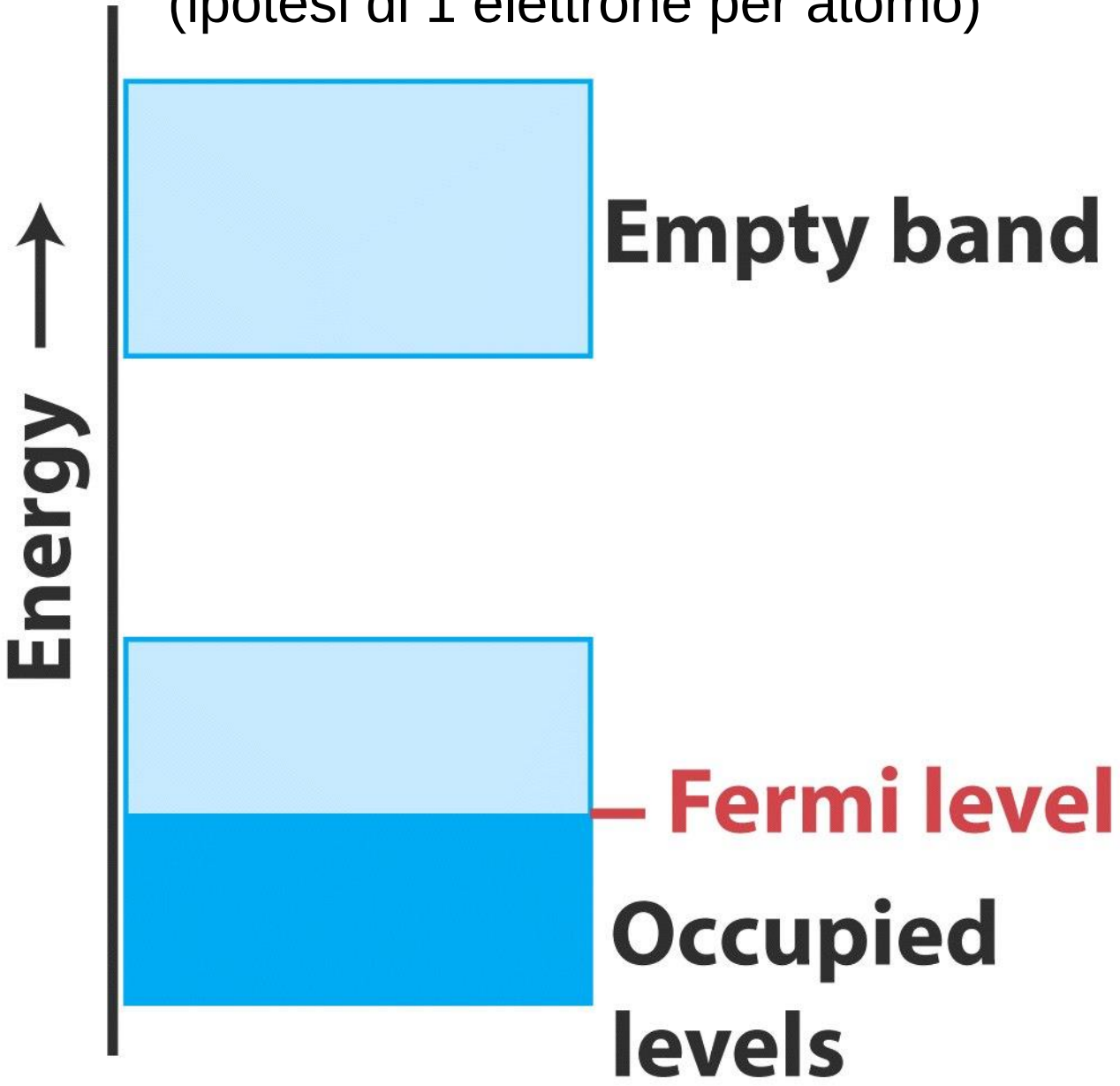

p band
Energy
Band gap
s band
p band
s band



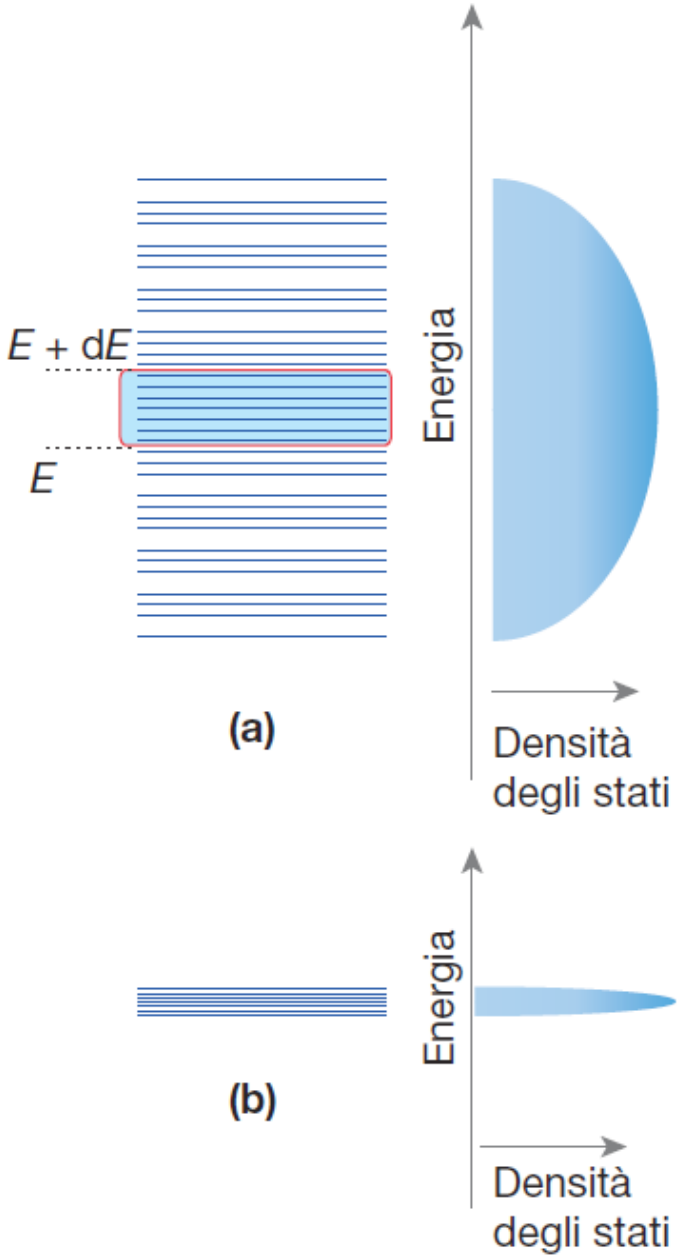
per qualsiasi solido si può generare un diagramma a bande, che viene costruito usando gli orbitali di frontiera di tutti gli atomi presenti.

Solido conduttore metallico

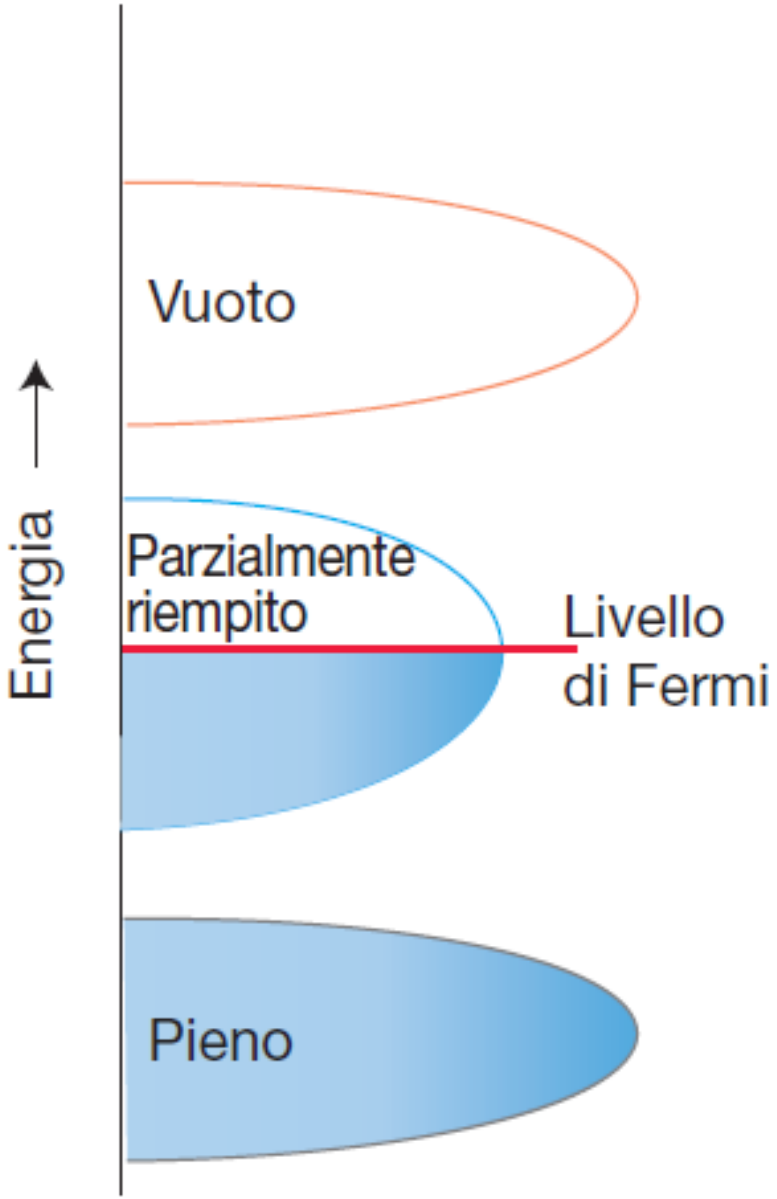
(ipotesi di 1 elettrone per atomo)



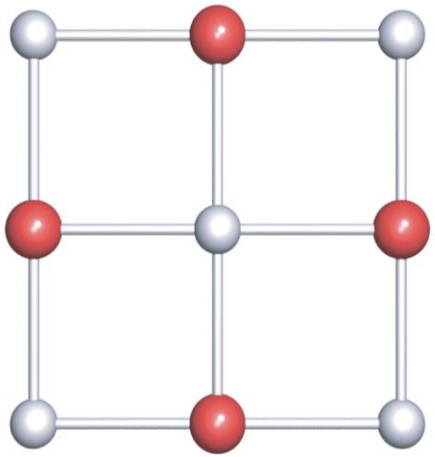
Densità degli stati elettronici

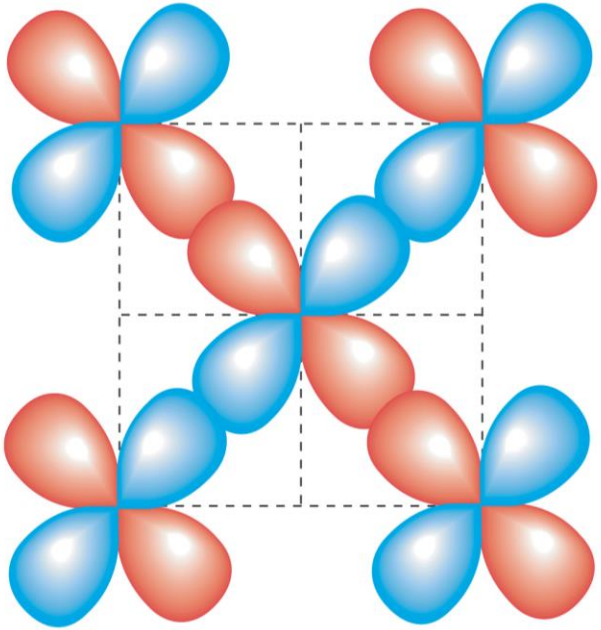


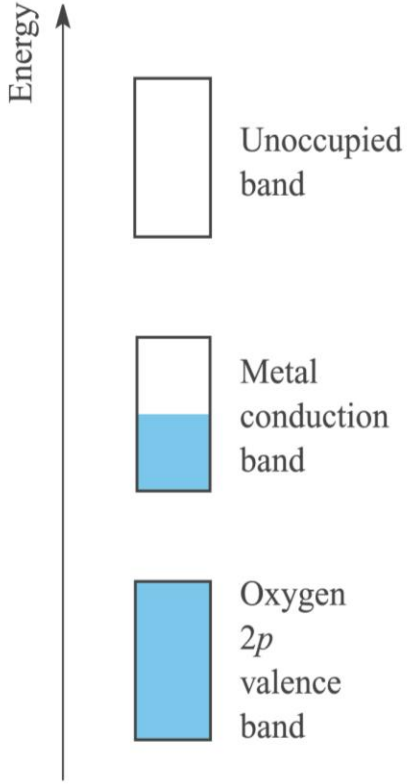
Tipiche densità di stati in un metallo



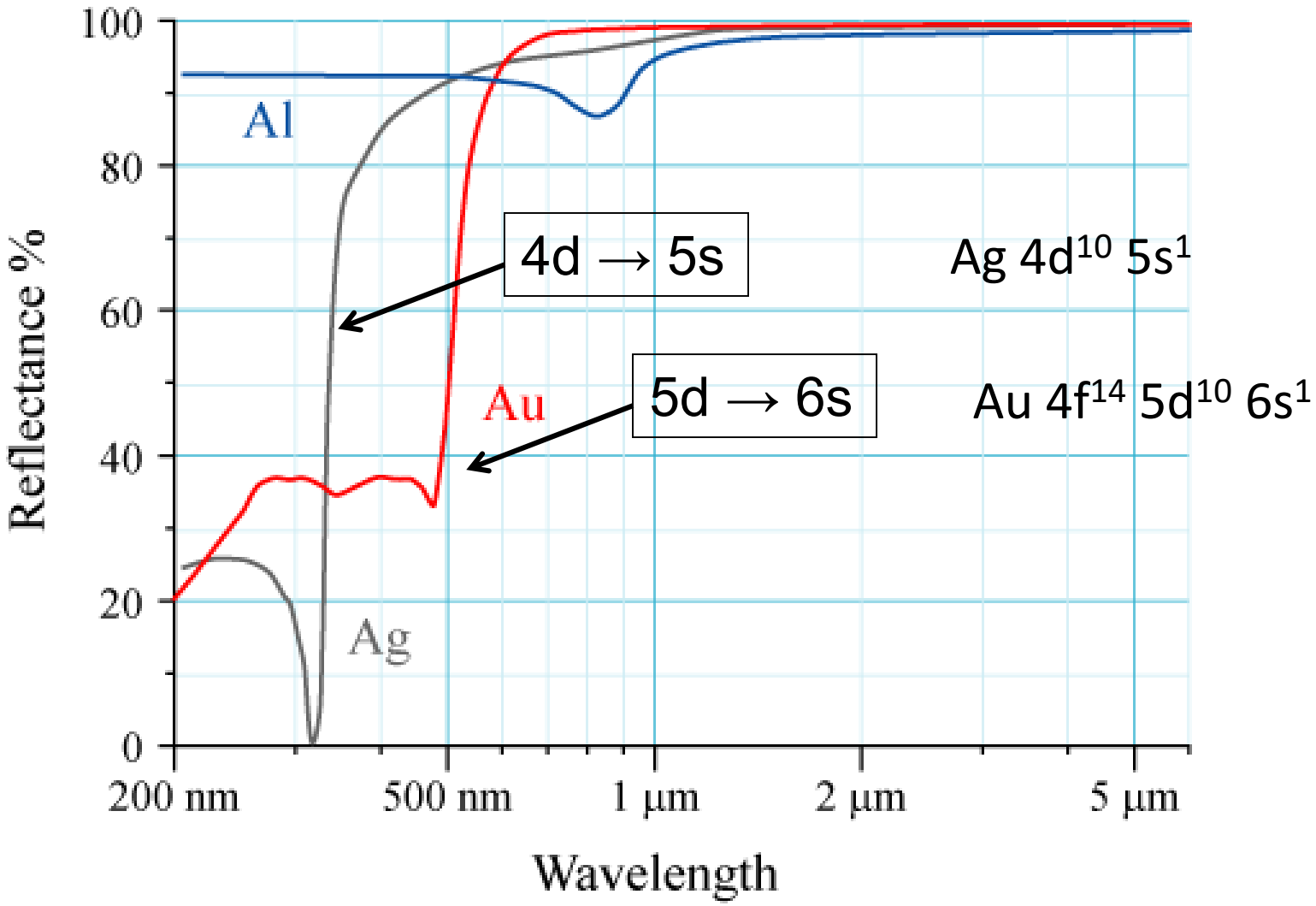
TiO, un ossido metallico conduttore







Effetti relativistici e colore dell'oro



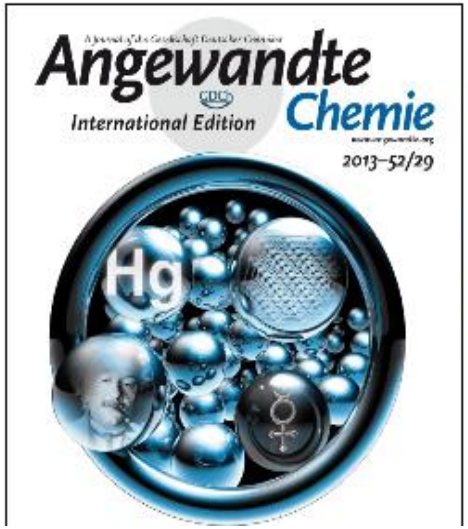
Perché il mercurio è liquido

Cover Picture: Evidence for Low-Temperature Melting of Mercury owing to Relativity (Angew. Chem. Int. Ed. 29/2013)

Dr. Florent Calvo, Dr. Elke Pahl, Dr. Michael Wormit, Prof. Dr. Peter Schwerdtfeger

Pages: 7323 | First Published: 21 June 2013

Hg $4f^{14}\ 5d^{10}\ 6s^2$

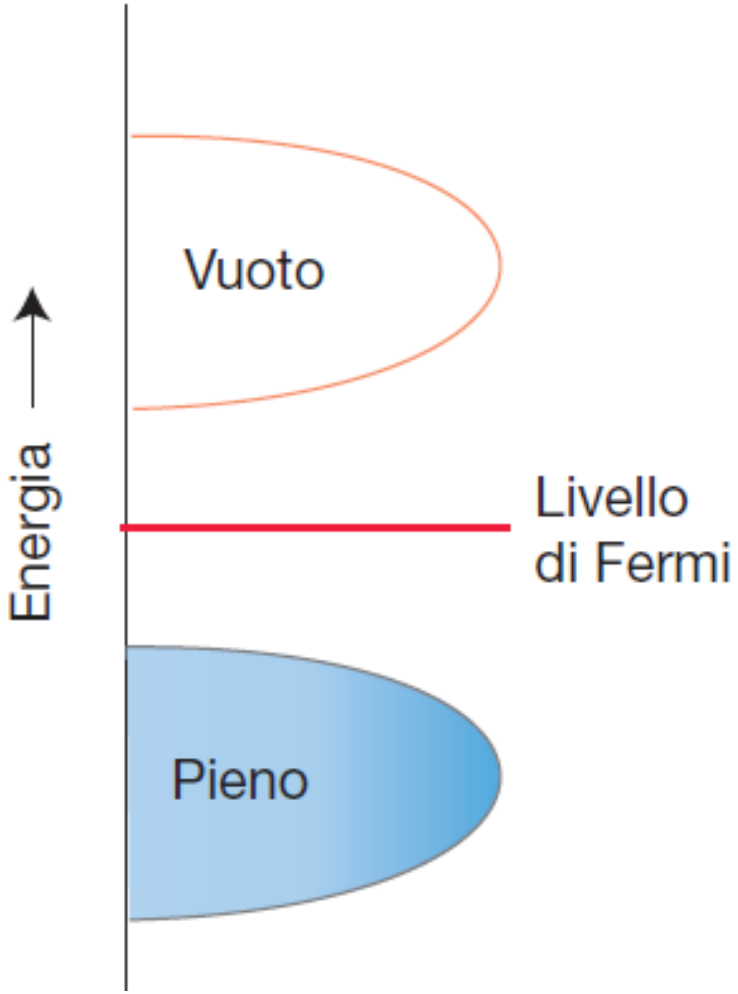


The generalized theory of relativity gives a correct explanation of the residual motion of the perihelion of planet mercury. As F. Calvo, P. Schwerdtfeger, et al. show in their Communication on page 7583 ff., the special theory of relativity has furnished an even more remarkable result. It gives the correct explanation as to why mercury is the only liquid metal at room temperature, as demonstrated by parallel-tempering Monte Carlo simulations (Picture: Cameron Smorenburg).

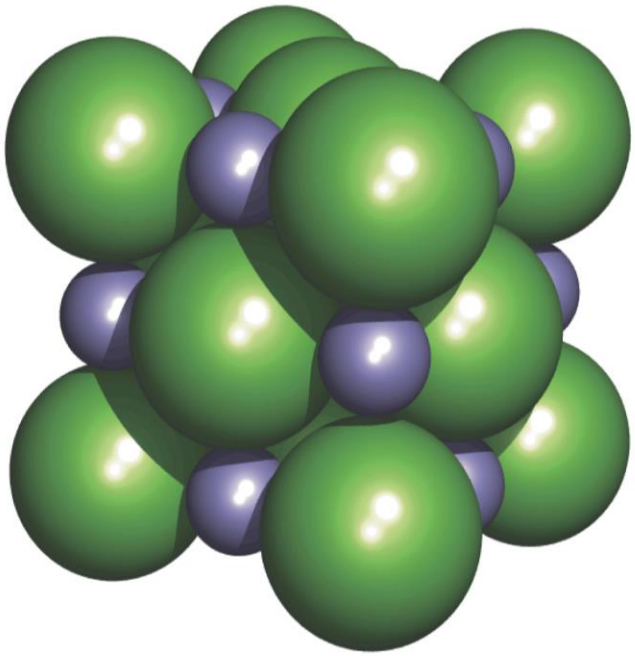
https://www.youtube.com/watch?v=NtnsHtYYKf0

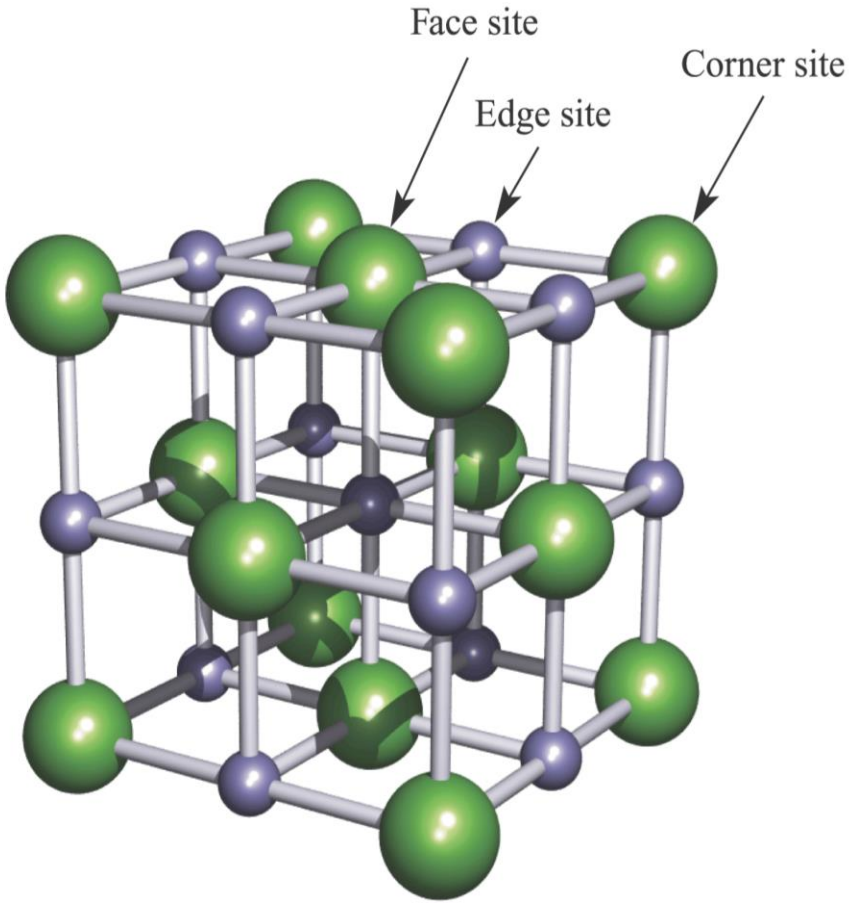
L. J. Norrby Why is mercury liquid *J. Chem. Ed.* **1991**, *68*, 110.

Tipiche densità di stati in un semiconduttore/isolante

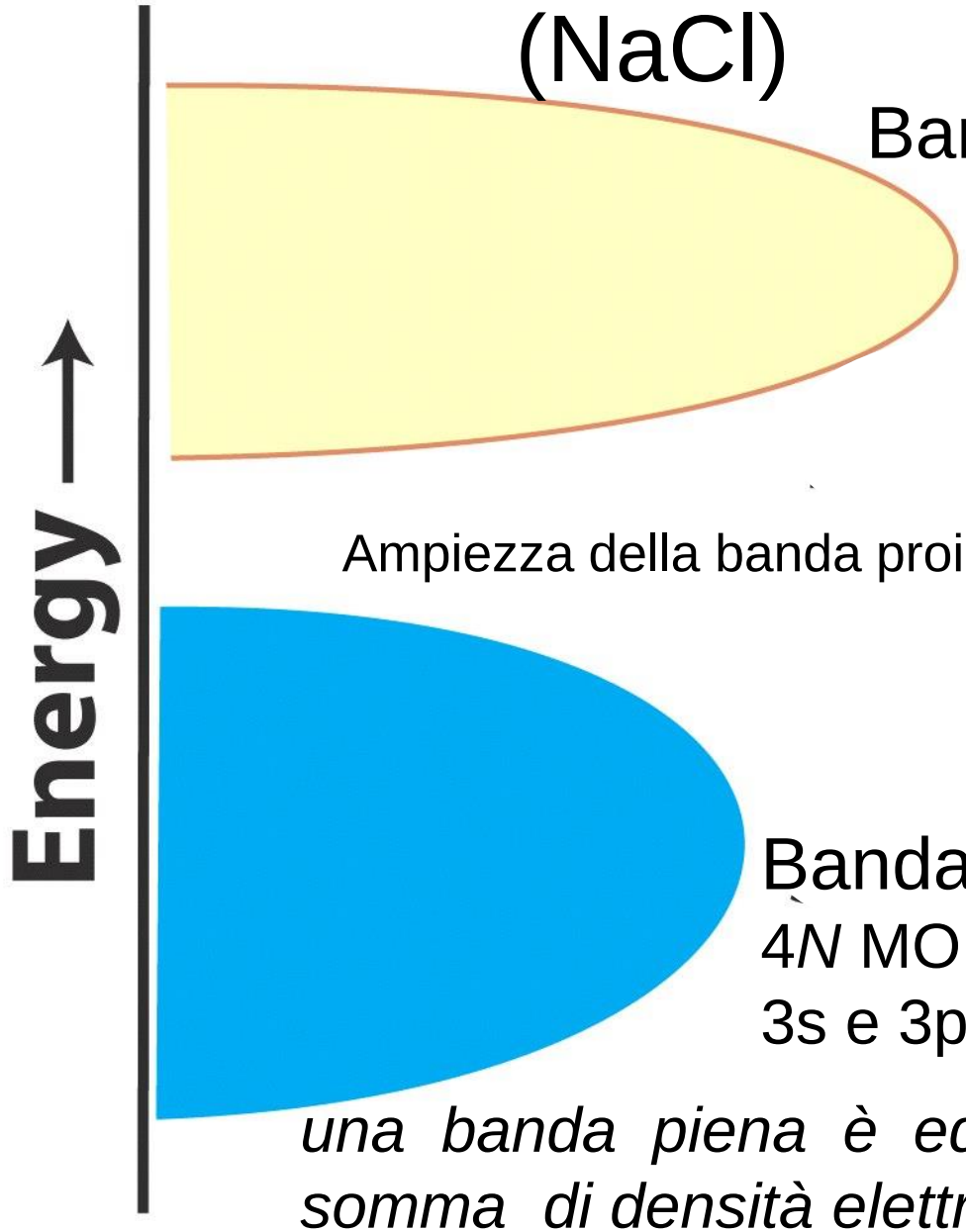


NaCl





Tipiche densità di stati in un isolante (NaCl)



Banda di conduzione
(banda degli Na)

Ampiezza della banda proibita in NaCl = ca. 7 eV

Banda di valenza
4*N* MO dagli orbitali atomici
3s e 3p dei Cl

una banda piena è equivalente a una somma di densità elettroniche localizzate

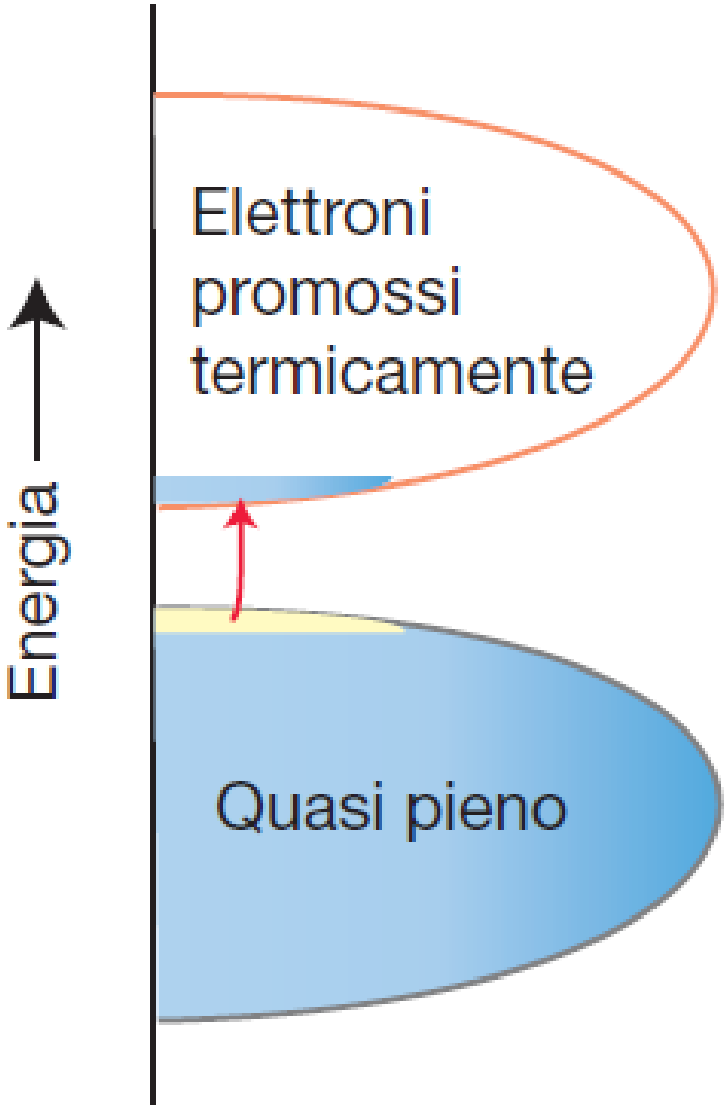
Alcune ampiezze di bande proibite

Materiale	E_g/eV
Carbone (diamante)	5,47
Carburo di silicio	3,00
Silicio	1,11
Germanio	0,66
Arseniuro di gallio	1,35
Arseniuro di indio	0,36

La linea di divisione tra isolanti e semiconduttori dipende dalle dimensioni della banda proibita

Semiconduttore intrinseco

andamento di tipo Arrhenius della conducibilità con la temperatura

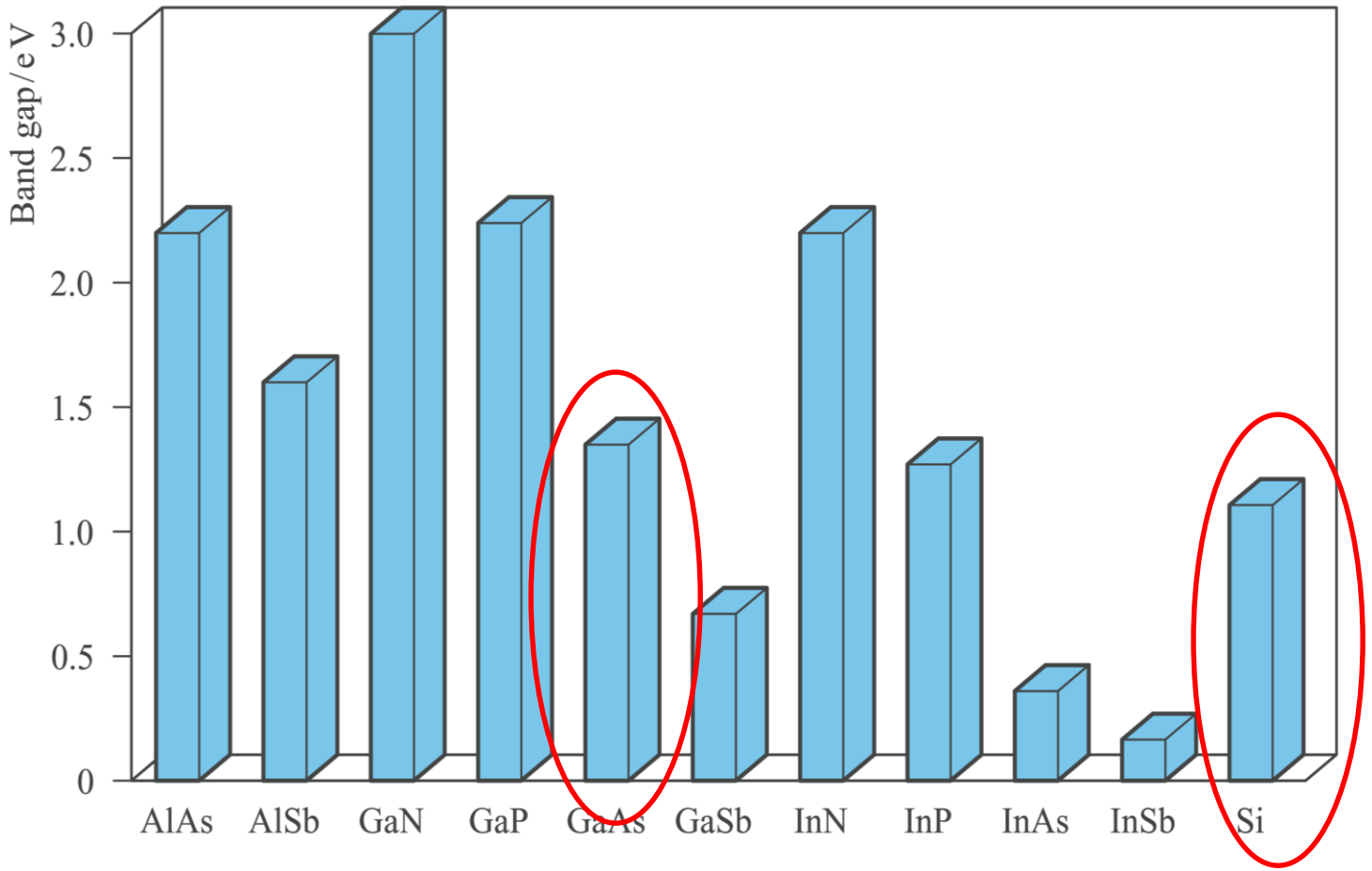


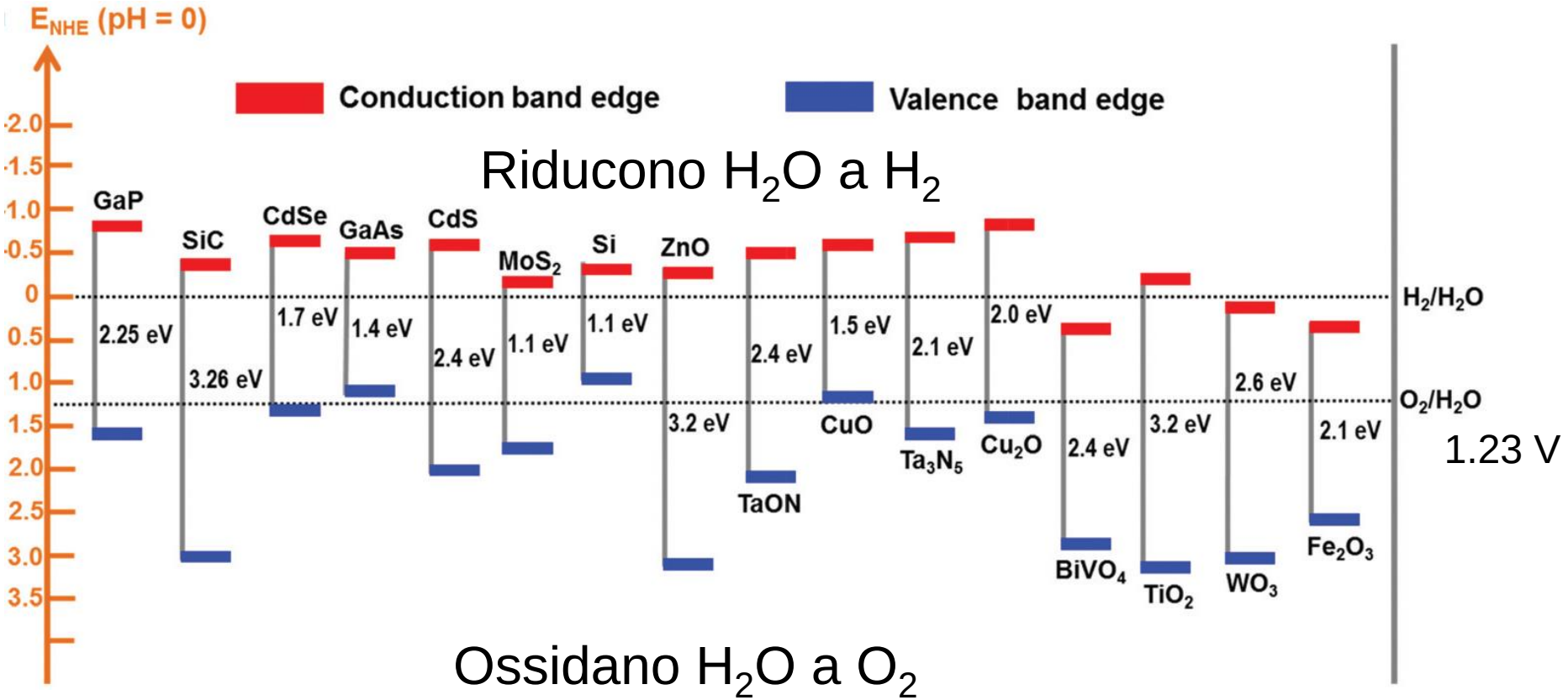
Banda di conduzione

$$\sigma = \sigma_0 e^{-E_g/2kT}$$

Banda di valenza

Bande proibite in **semiconduttori III – V** (o 13 – 15) *vs* silicio

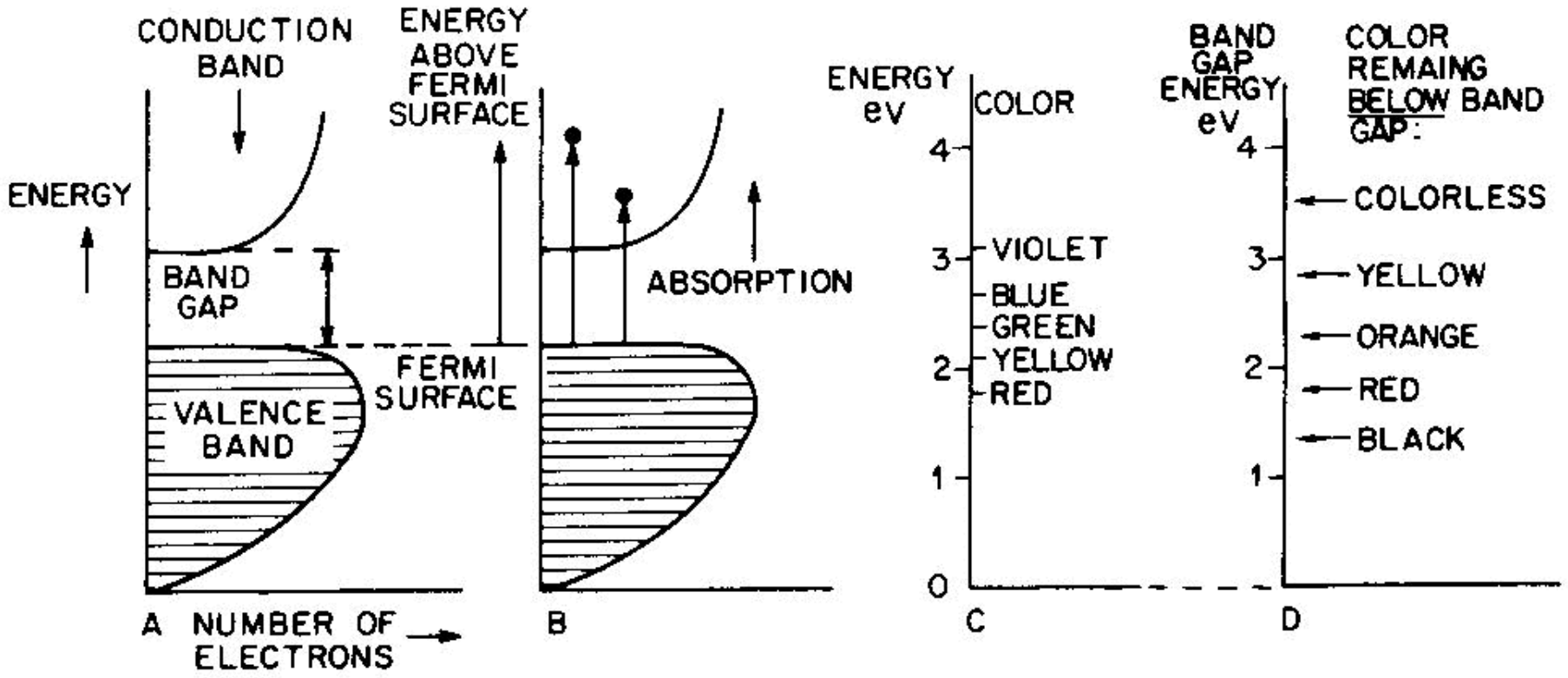




Riducono H_2O a H_2

Ossidano H_2O a O_2

La promozione di elettroni dalla banda proibita a quella di valenza può essere indotta dalla luce



e.g. la galena, PbS, è grigio-nera poiché il band gap è solo 0.4 eV, cioè assorbe tutto il range della luce visibile.

Luce emessa dai LED (*light emitting diodes*) in funzione della composizione

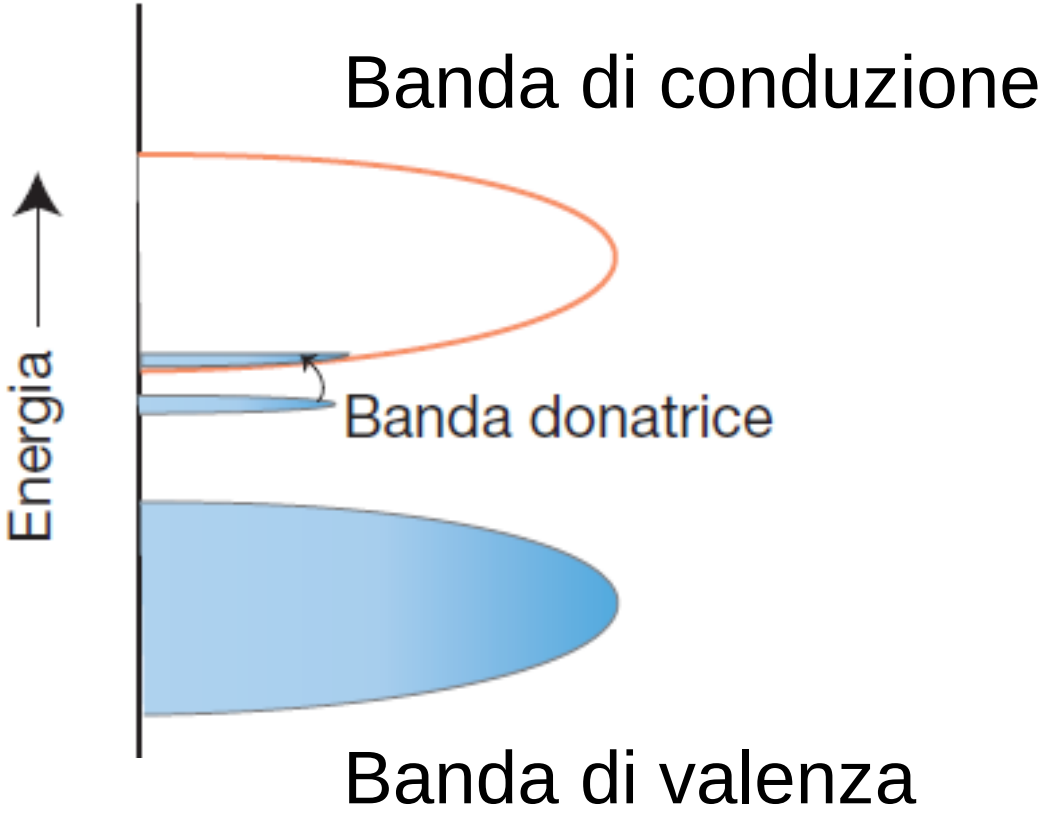
x in $GaAs_{1-x}P_x$	Substrate	λ / nm	Observed colour or region of spectrum
0.10	GaAs	780	Infrared
0.39	GaAs	660	Red
0.55	GaP	650	Red
0.65	GaP	630	Orange
0.75	GaP	610	Orange
0.85	GaP	590	Yellow

Semiconduttori estrinseci

(drogaggio sostitutivo)

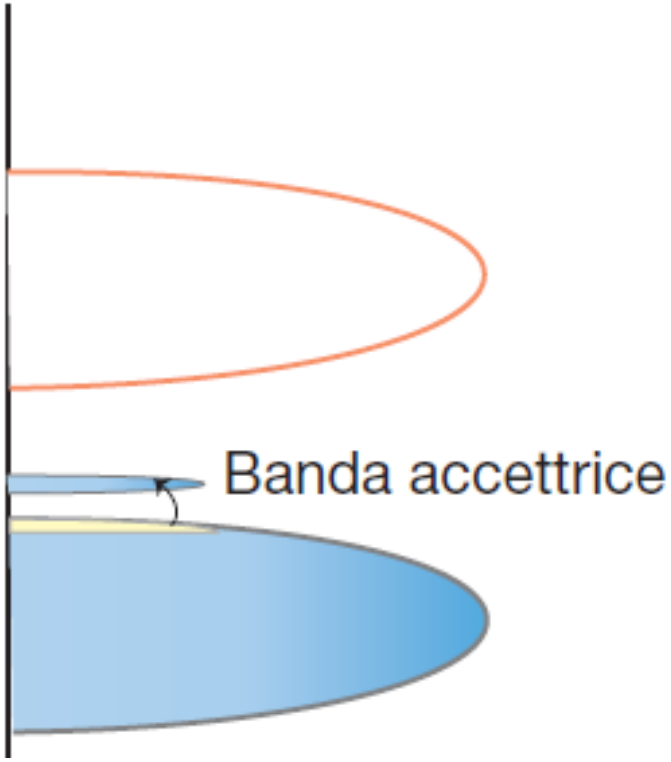
Tipo n

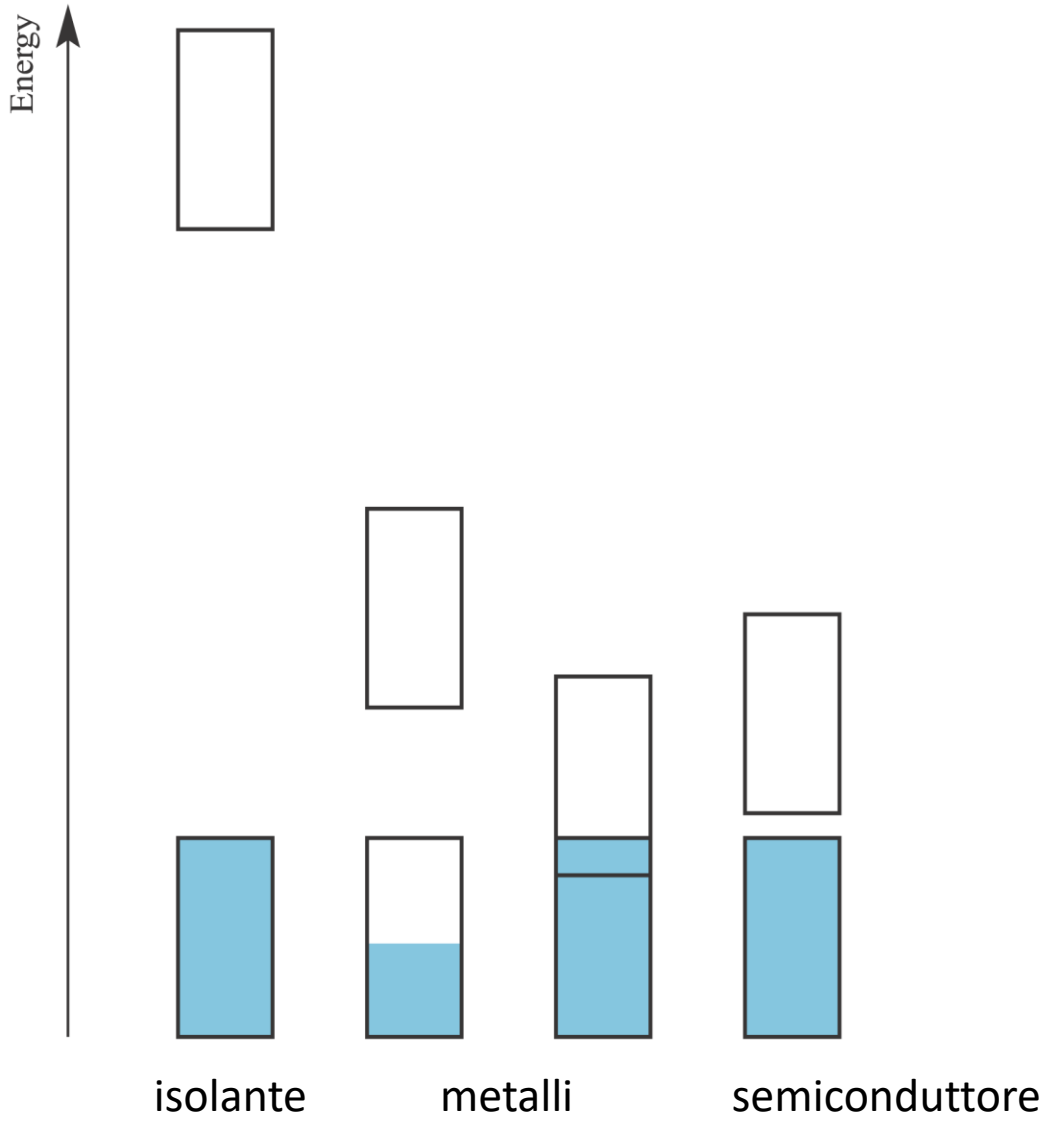
e.g. Si drogato con As



Tipo p

e.g. Si drogato con Ga




Energy
isolante
metalli
semiconduttore