

# Dva typy řešení stacionární Schrödingerovy rovnice

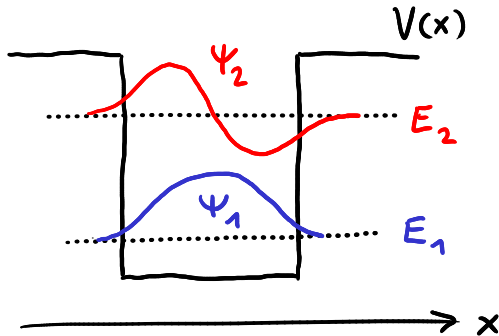
stacionární SR 
$$\left[ -\frac{\hbar^2}{2m} \frac{d^2}{dx^2} + V(x) \right] \Psi(x) = E \Psi(x)$$

→ soubor vlastních stavů  $\Psi_n(x)$  a vlastních energií  $E_n$

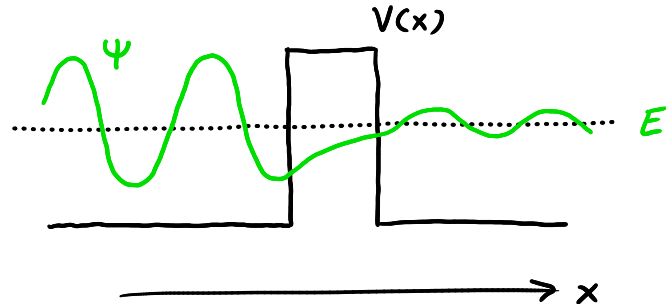
→ soubor stacionárních stavů  $\psi_n(x,t) = \Psi_n(x) e^{-\frac{i}{\hbar} E_n t}$

nestacionární SR 
$$\left[ -\frac{\hbar^2}{2m} \frac{\partial^2}{\partial x^2} + V(x) \right] \psi(x,t) = i\hbar \frac{\partial}{\partial t} \psi(x,t)$$

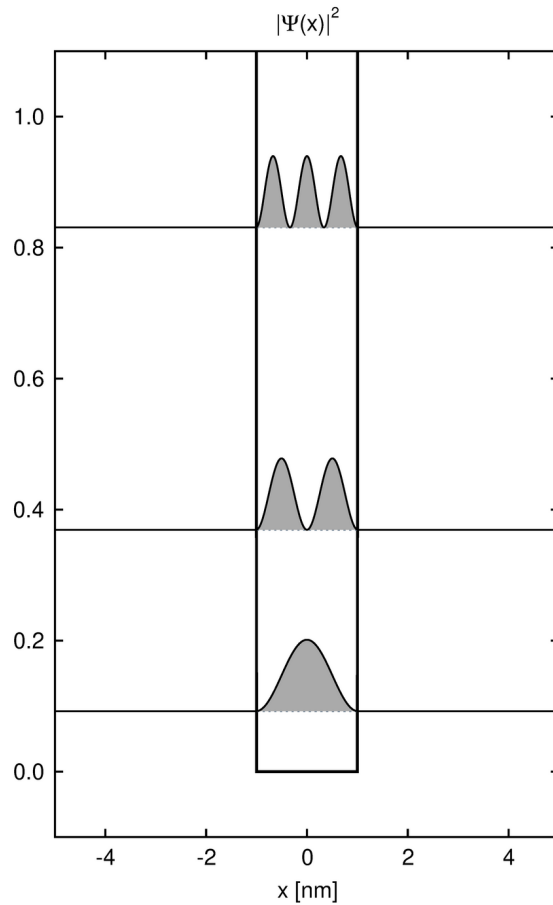
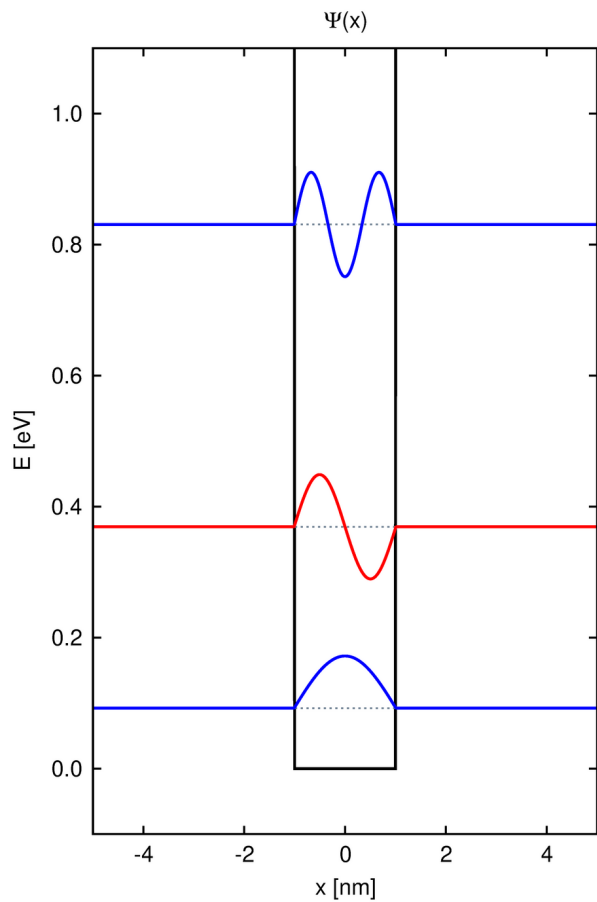
• vázané stavy



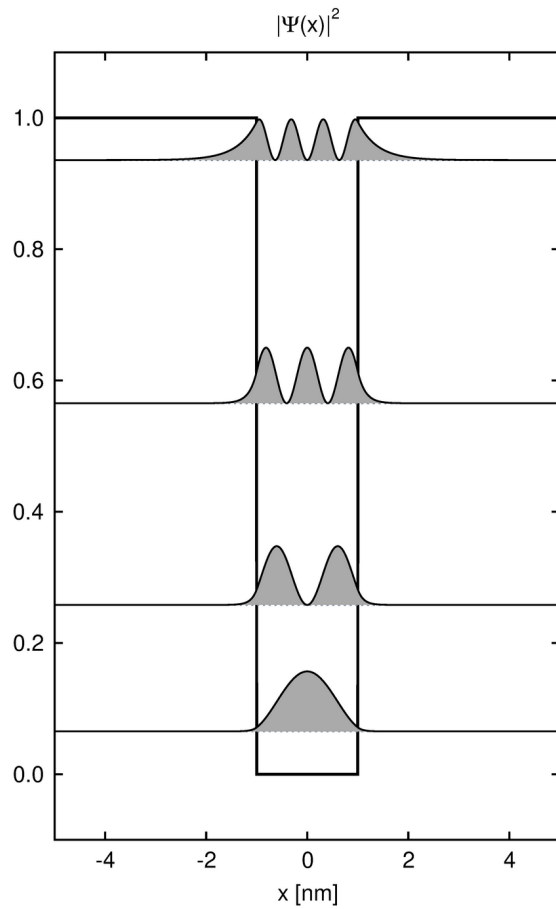
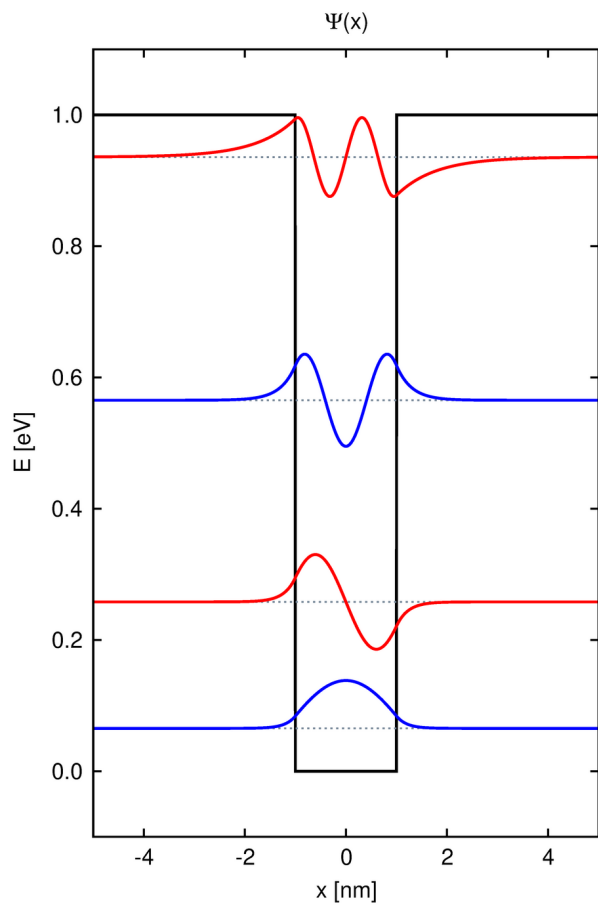
• rozptylové stavy

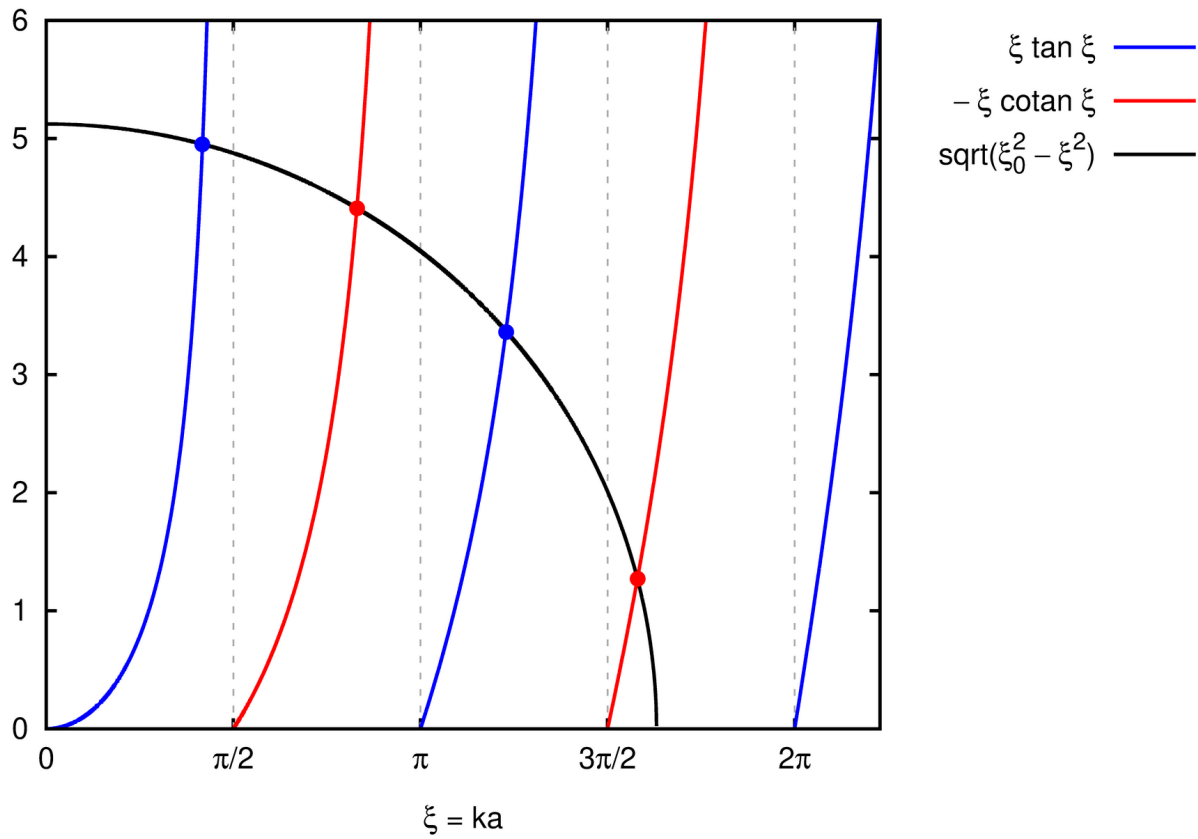


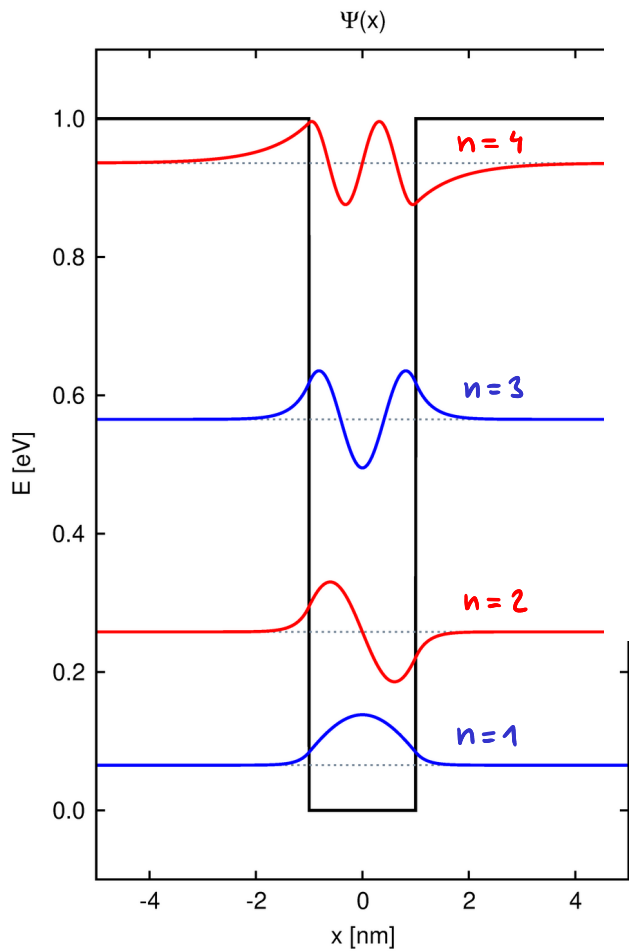
# Nekonečně hluboká kvantová jáma



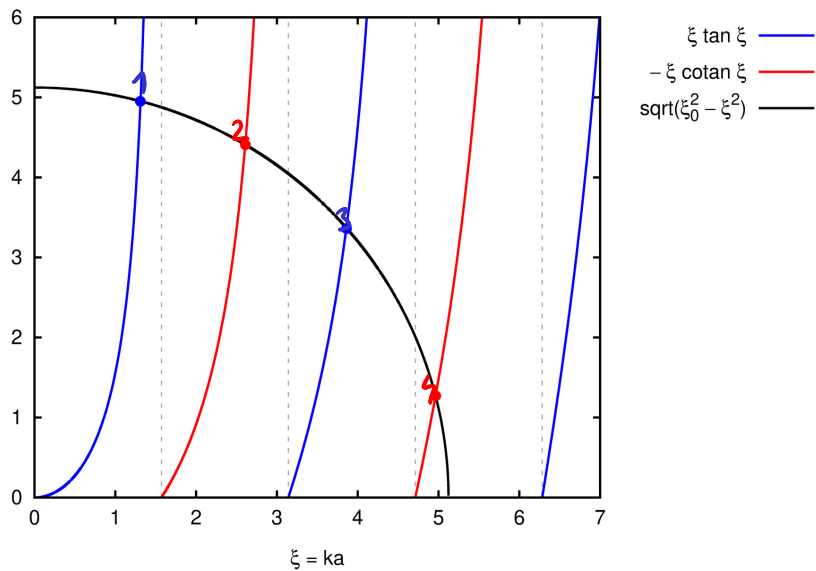
# Konečně hluboká kvantová jáma



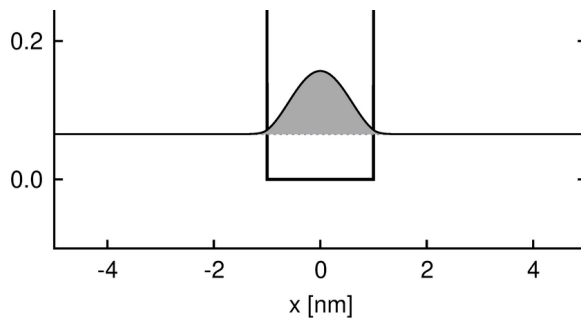




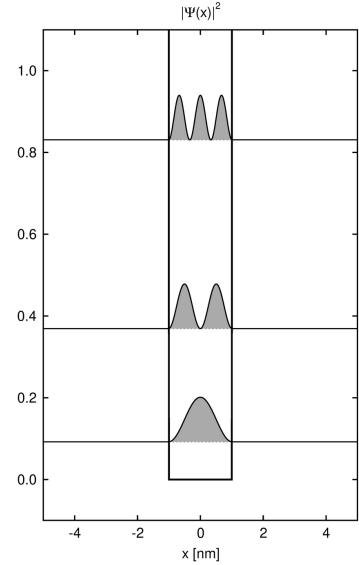
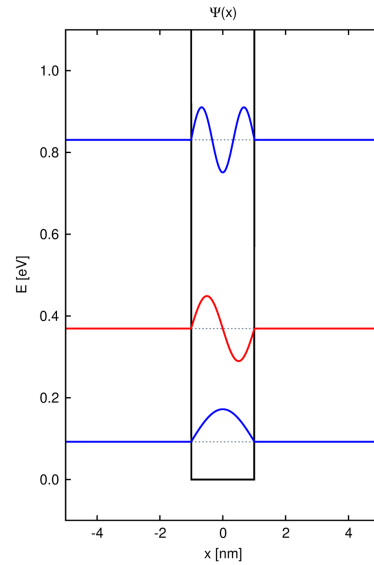
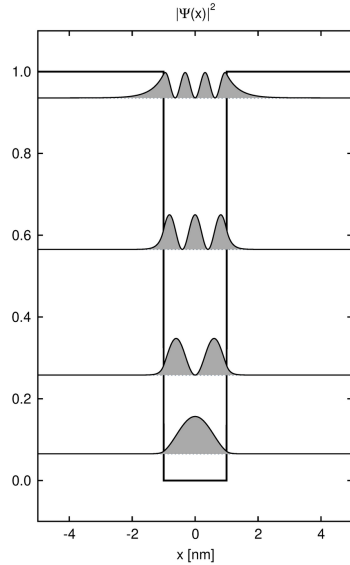
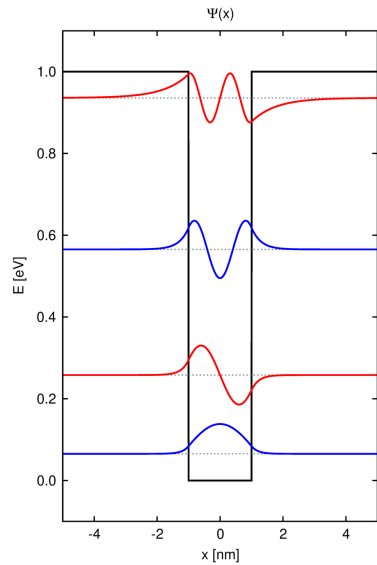
$V_0 = 1\text{eV}$     $a = 1\text{nm}$     $f_0 \approx 5.123$

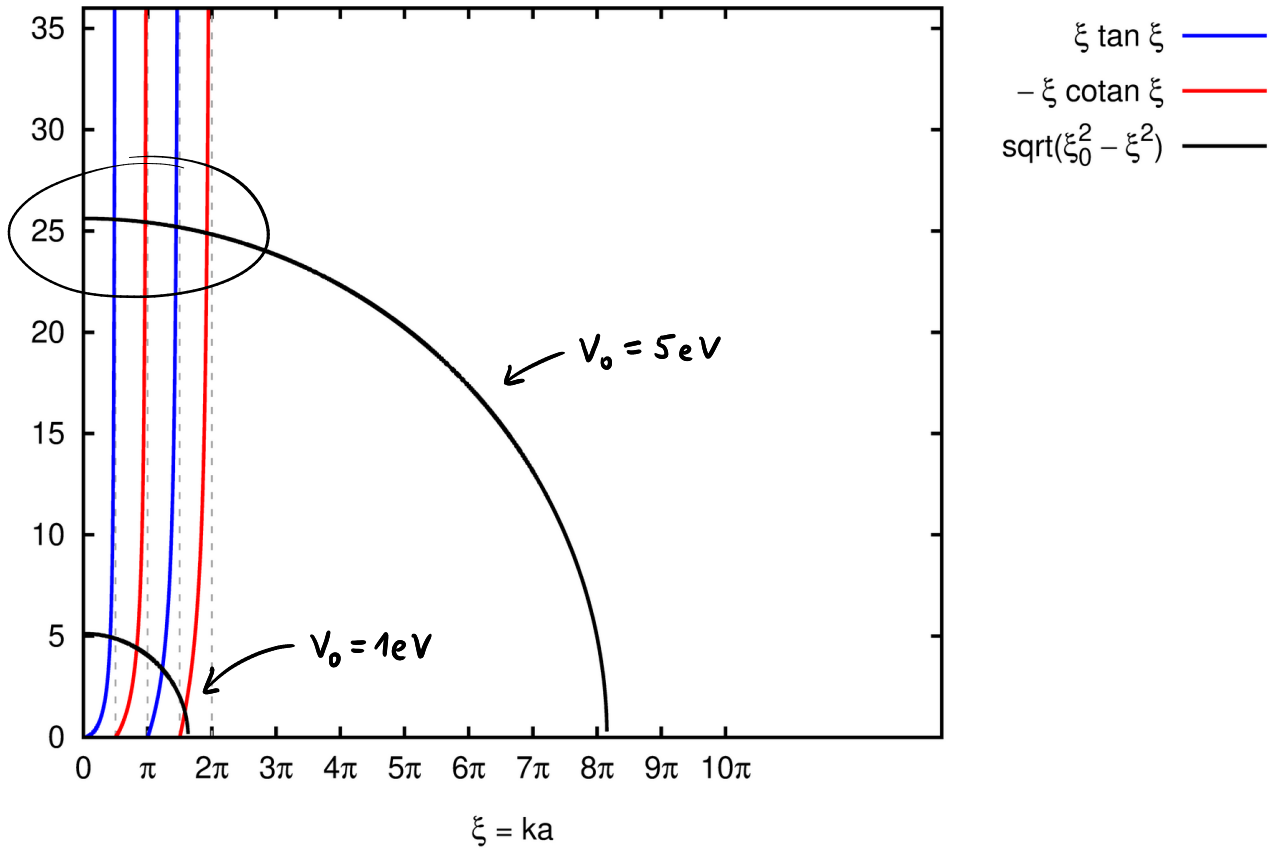


- $\xi \tan \xi$  — blue line
- $-\xi \cotan \xi$  — red line
- $\text{sqrt}(\xi_0^2 - \xi^2)$  — black line

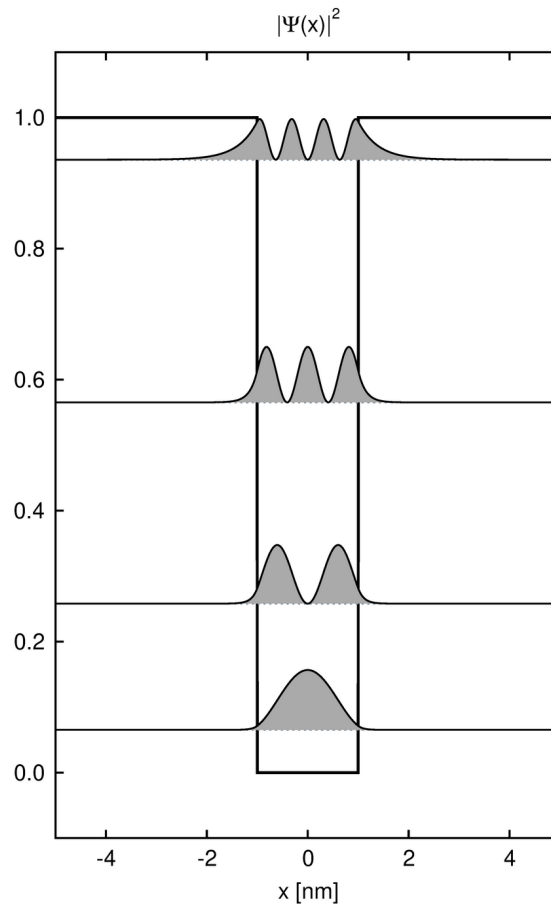
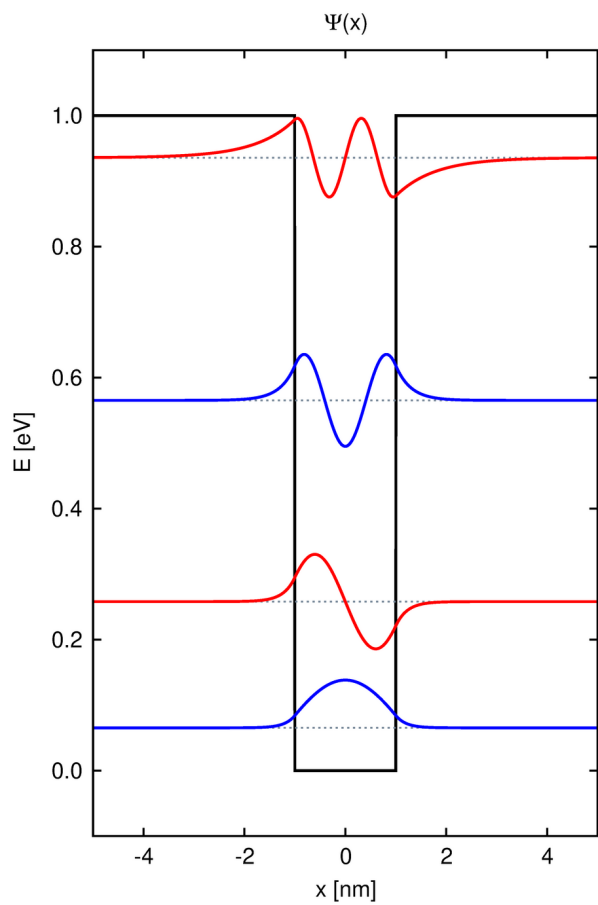


# Přechod k nekonečně hluboké jámě

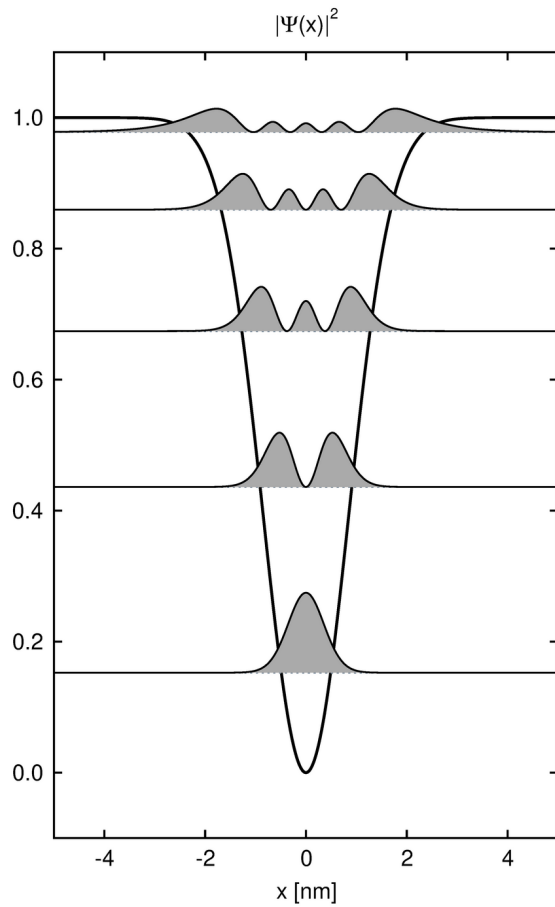
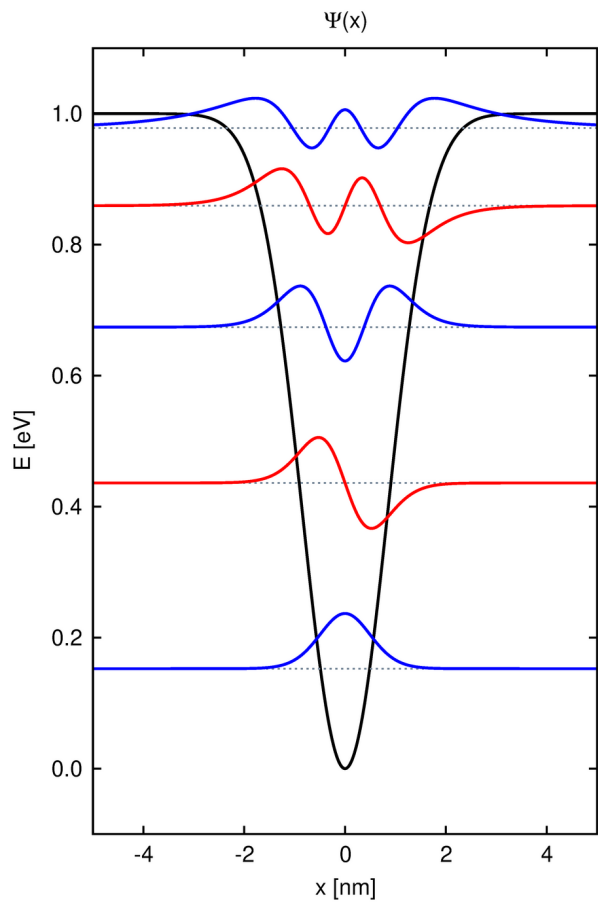


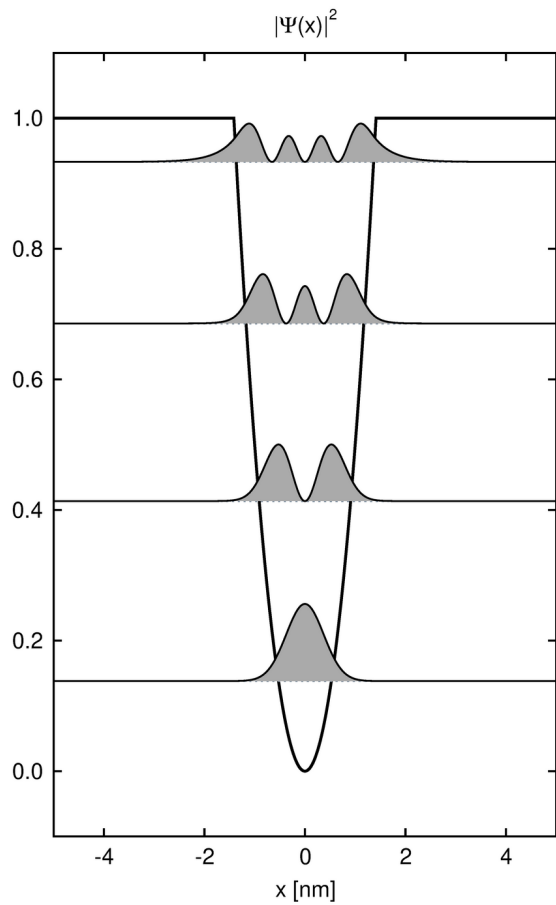
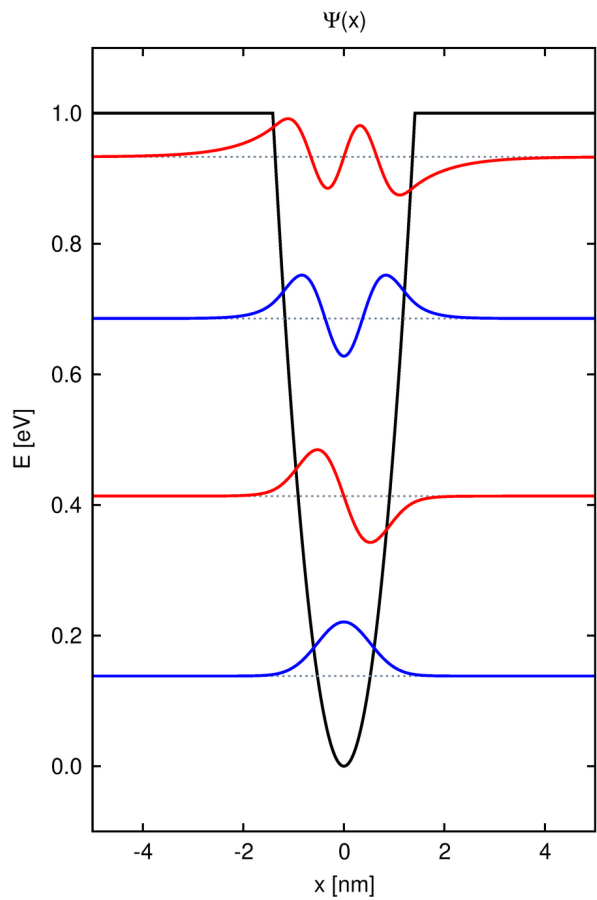


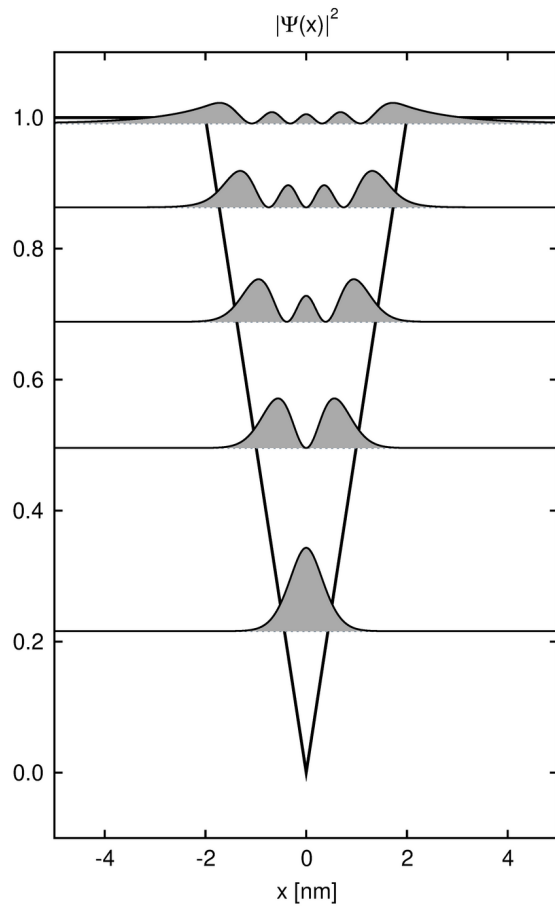
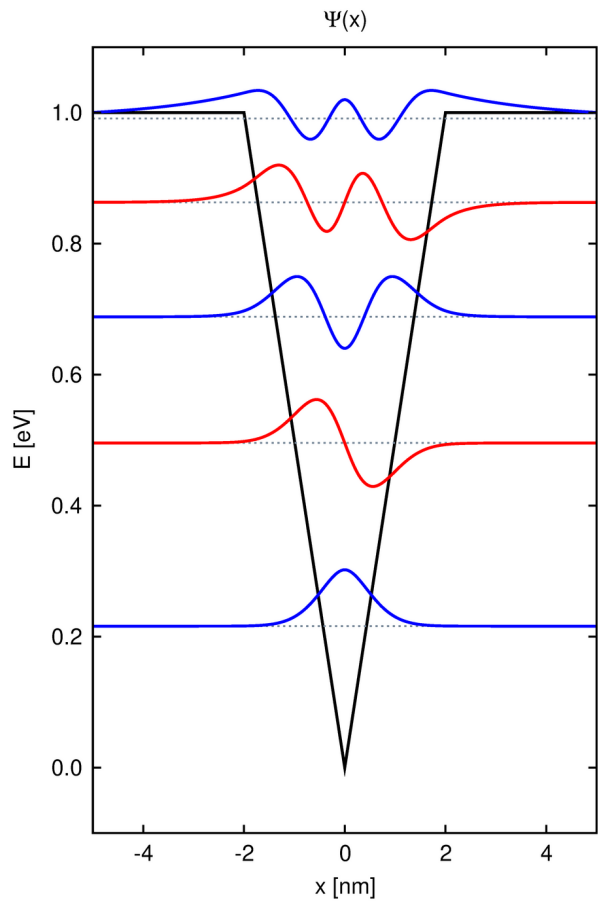
# Přehled vázaných stavů pro různé typy jam

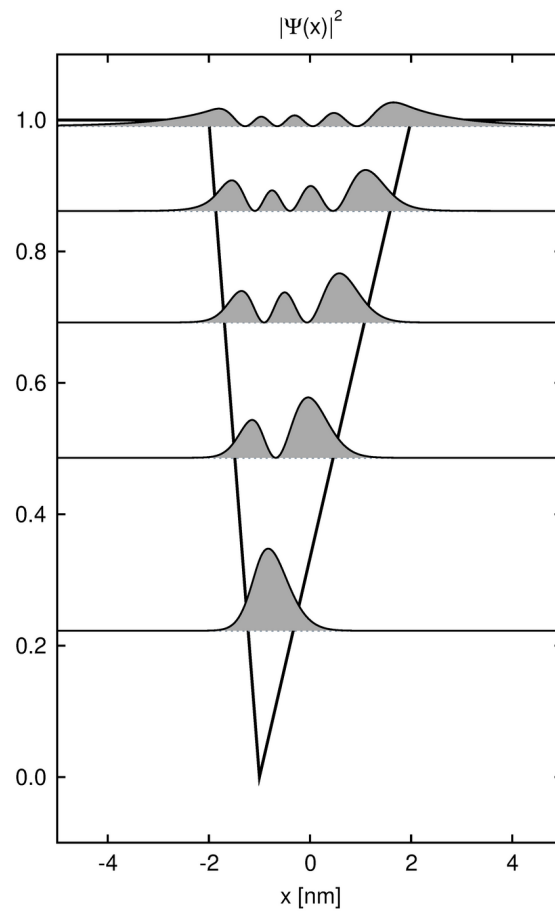
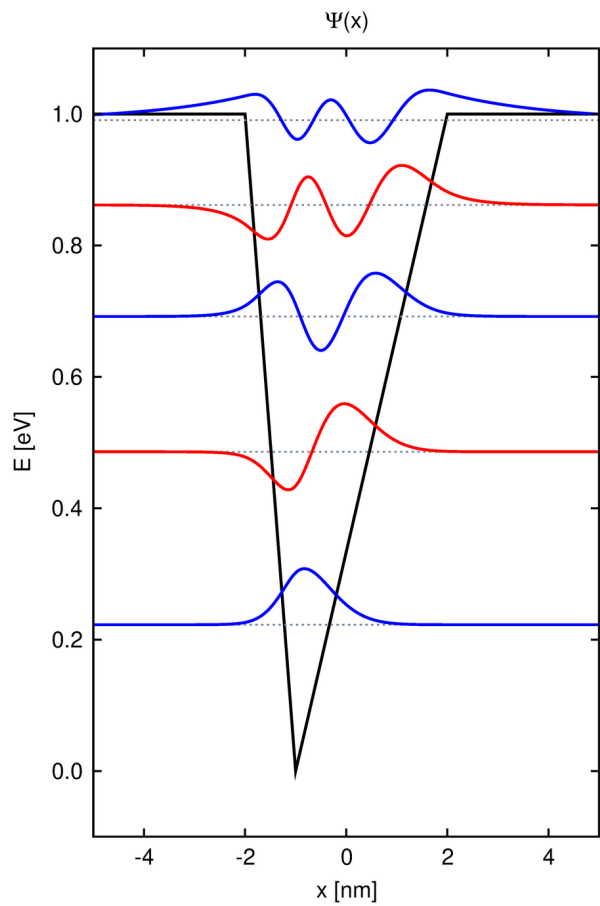




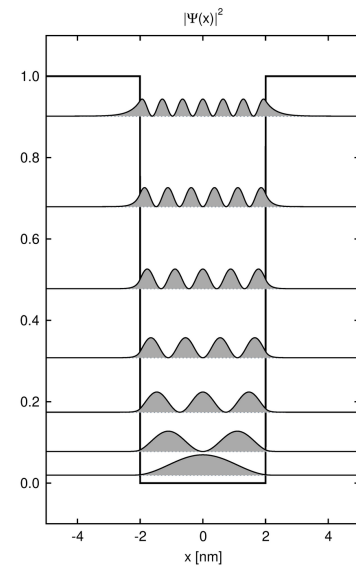
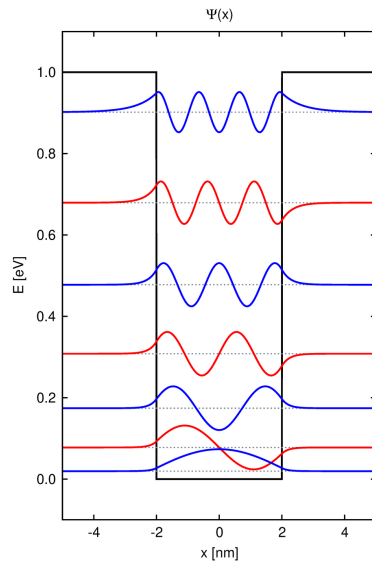
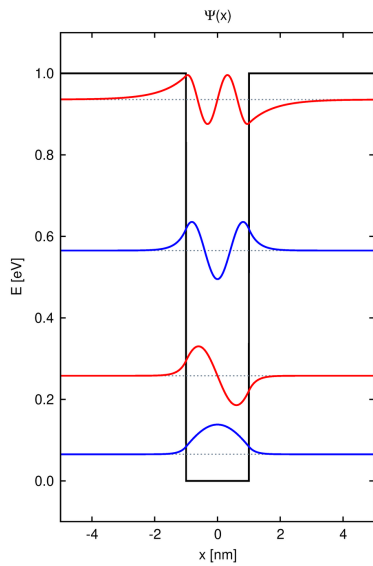
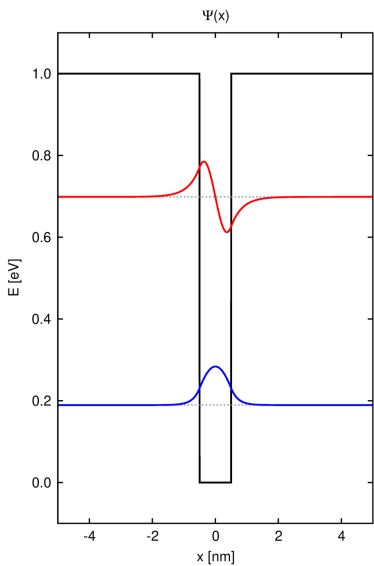




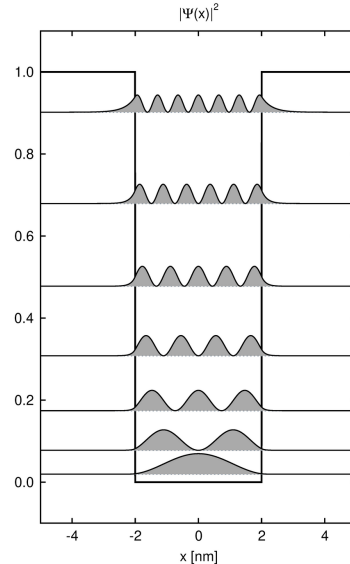
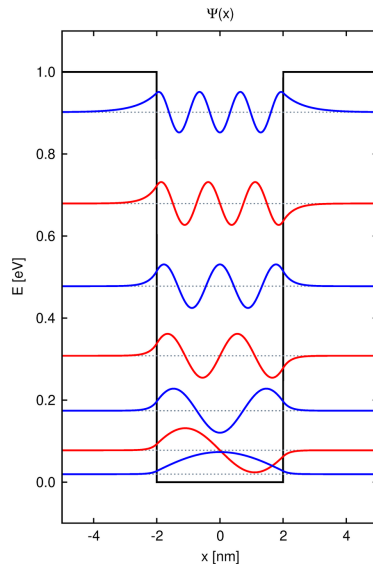
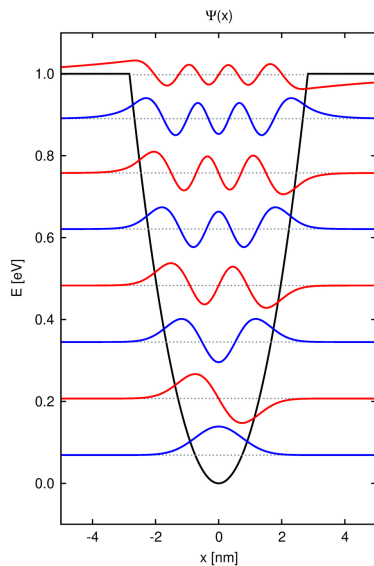
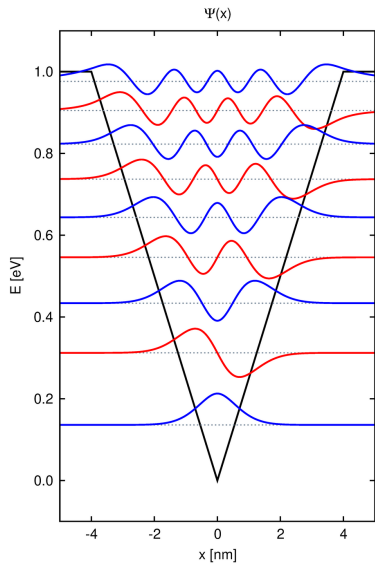




# Vliv šířky jámy na množství vázaných stavů

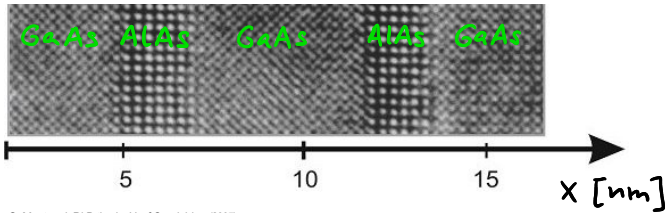


# Vliv tvaru jámy na rozložení energií vázaných stavů



# Kvantové jámy v optoelektronice

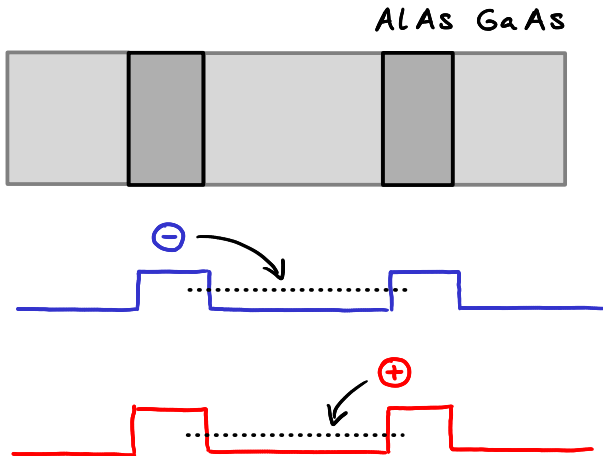
- polovodičové lasery



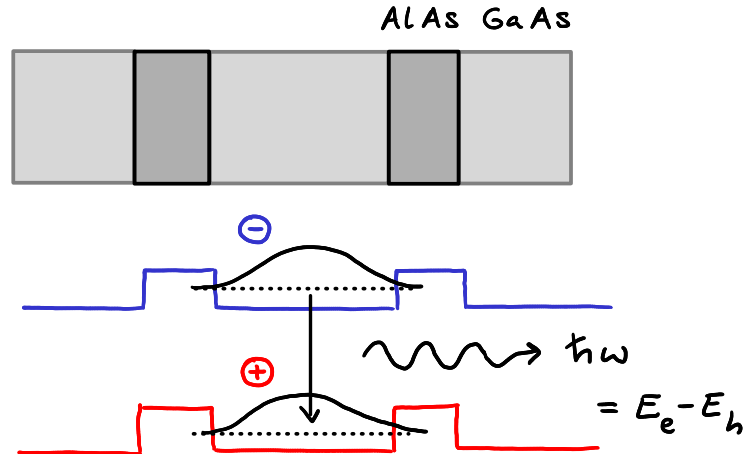
S. Montanari, PhD thesis, U. of Cambridge (2005)  
<https://www.dotpoms.ac.uk/tpl/tplbi/epitaxial-growth/intro.php>

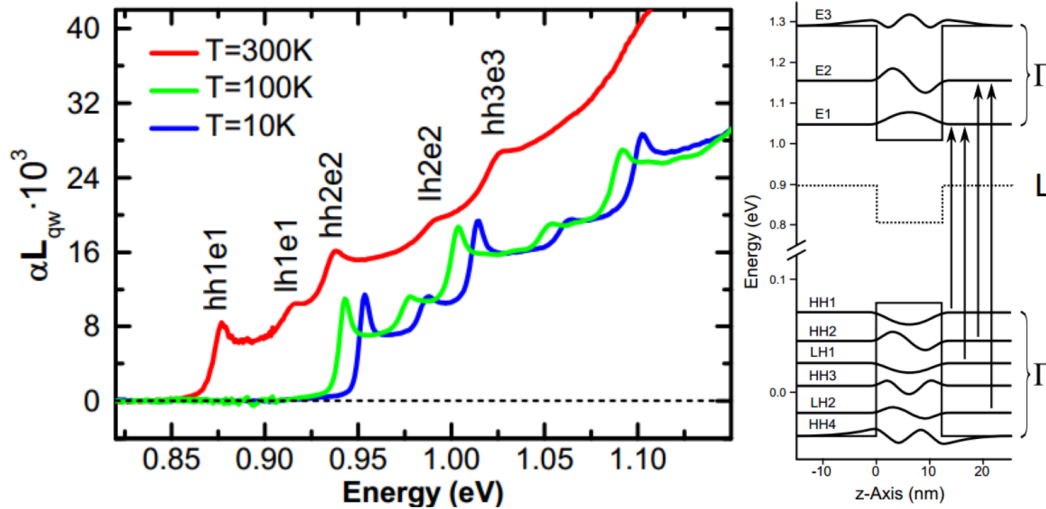
- InGaAsP/InP: IR lasery pro optické komunikace
- GaInP/AlGaInP: červené lasery (DVD, ukazovátka)
- InGaN: fialové/modré/zelené lasery (Blu-ray, dataprojektory, ukazovátka, osvětlení)

## 1. zachycení v kvantové jámě



## 2. rekombinace za vyzaření fotonu





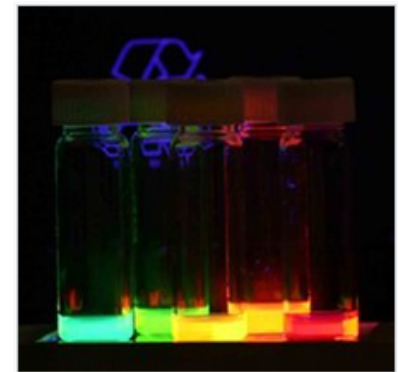
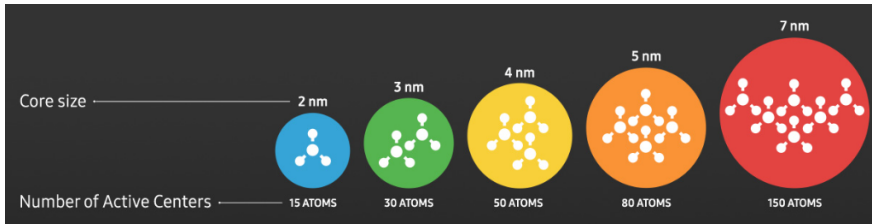
**Figure 2.** Linear absorption spectrum of the Ge multiple quantum well structure. A schematic sketch of the electronic structure according to [18] is given on the right-hand side.

N.S. Köster et al., New J. Phys. 15, 075004 (2013)

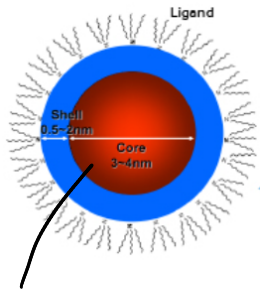
struktura vzorku: 14nm tluste' Ge jámy  
 20nm tluste'  $\text{Si}_{0.15}\text{Ge}_{0.85}$  bariéry } 50 opakova'ní



• QLED obrazovky ← polovodičové kvantové tečky



Colloidal quantum dots irradiated with a UV light. Differently sized quantum dots emit different colors of light due to quantum confinement.



InP

