

Pm



SVEUČILIŠTE U SPLITU

PRIRODOSLOVNO
MATEMATIČKI
FAKULTET



[Odjel za fiziku]

Fizika - pokretač budućih tehnologija

Ante Bilušić
Odjel za fiziku, PMF u Splitu

NOBELOVE NAGRADE ZA FIZIKU BITNE ZA RAZVOJ MODERNIH TEHNOLOGIJA

godina	tema	dobitnici
1956.	poluvodički tranzistor	Shockley, Bardeen, Brattain
1967.	nuklearne reakcije	Bethe
1970.	magnetohidrodinamika; anti- i feri-magnetizam	Gösta Alven; Néel
1971.	holografija	Gabor
1972.	teorija (klasične) supravodljivosti	Bardeen, Cooper, Schrieffer
1973.	efekti tuneliranja u supravodičima i poluvodičima	Esaki, Giaever, Josephson
1977.	elektronska struktura magnetskih i neuređenih sustava	Anderson, Mott, van Vleck
1981.	laserska spektroskopija	Bloembergen, Schawlow, Siegbahn
1986.	elektronski mikroskop, pretražni tunelirajući mikroskop	Ruska; Binnig, Rohrer
1987.	visokotemperaturna supravodljivost	Bednorz, Müller
1991.	tekući kristali i polimeri	de Gennes
1994.	za razvoj tehnika raspršenja neutrona	Brockhouse, Shull

NOBELOVE NAGRADE ZA FIZIKU BITNE ZA RAZVOJ MODERNIH TEHNOLOGIJA

godina	tema	dobitnici
2000.	razvoj informacijskih tehnologija	Alferov, Kroemer (vrlo brza i optoelektronika), Kilby (IC)
2003.	razumijevanje supravodljivosti i suprafluidnosti	Abrikosov, Ginzburg, Laggett
2005.	optička koherencija (laser)	Glauber (teorija), Hall i Hänsch (eksperiment)
2007.	gigantski magnetootpor	Fert, Grünberg
2009.	optička vlakna; CCD-senzor	Kuen Kao; Boyle, Smith
2010.	grafen	Geim, Novoselov
2012.	mjerenje i manipulacija kvantnim sustavima	Haroche, Wineland
2014.	plave svjetleće diode	Akasaki, Amano, Nakamura
2016.	topološki fazni prijelazi i topološke faze	Thouless, Haldane, Kostelitz

POSTOJEĆE TEHNOLOGIJE

RAČUNALNE MEMORIJE

1970.	magnetohidrodinamika; anti- i feri-magnetizam	Gösta Alven; Néel
1977.	elektronska struktura magnetskih i neuređenih sustava	Anderson, Mott, van Vleck
2007.	gigantski magnetootpor	Fert, Grünberg

INFORMACIJSKE TEHNOLOGIJE

1956.	poluvodički tranzistor	Shockley, Bardeen, Brattain
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MONITORI I TELEVIZORI

1991.	tekući kristali i polimeri	de Gennes
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EKOLOŠKA RASVJETA

2014.	plave svjetleće diode	Akasaki, Amano, Nakamura
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DOLAZEĆE TEHNOLOGIJE

FUZIJSKI REAKTOR

1967.	nuklearne reakcije	Bethe
1970.	magnetohidrodinamika; anti- i feri-magnetizam	Gösta Alven; Néel

NANOTEHNOLOGIJA

1986.	elektronski mikroskop, pretražni tunelirajući mikroskop	Ruska; Binning, Rohrer
2010.	grafen	Geim, Novoselov
2012.	mjerenje i manipulacija kvantnim sustavima	Haroche, Wineland

SUPRAVODLJIVOST

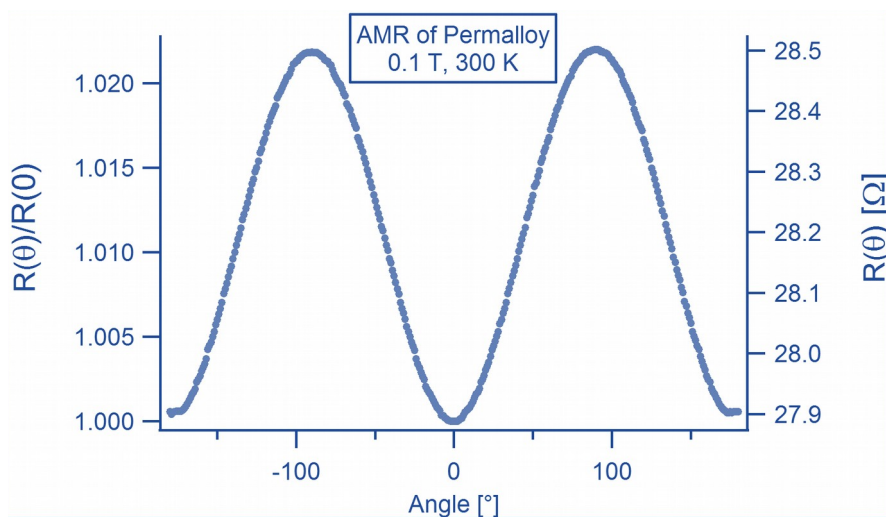
1972.	teorija (klasične) supravodljivosti	Bardeen, Cooper, Schrieffer
1973.	efekti tuneliranja u supravodičima i poluvodičima	Esaki, Giaver, Jospehson
1987.	visokotemperaturna supravodljivost	Bednorz, Müller
2003.	razumijevanje supravodljivosti i suprafluidnosti	Abrikosov, Ginzburg, Laggett

RAČUNALNE MEMORIJE

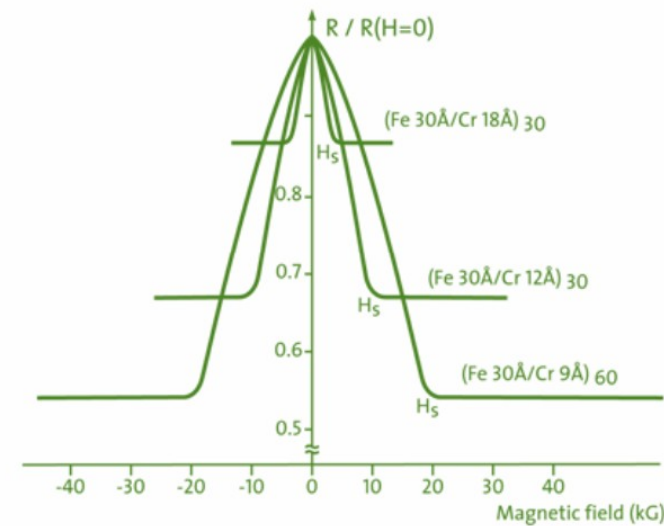
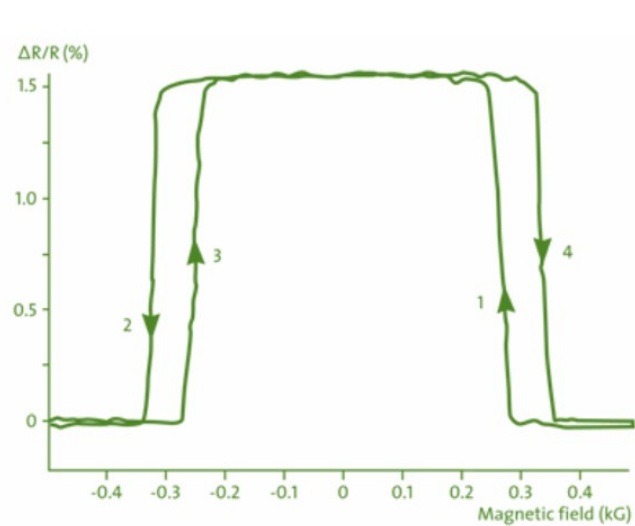
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magnetootpor...

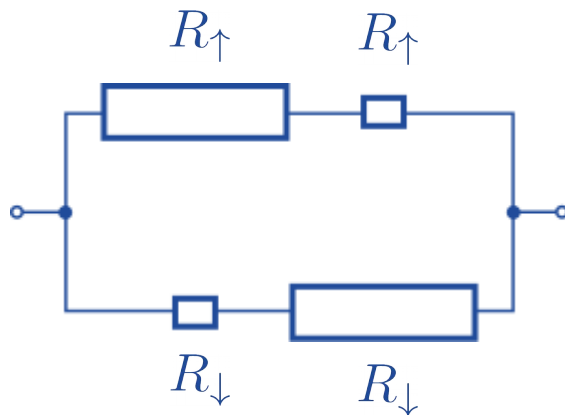


...i gigantski magnetootpor



RAČUNALNE MEMORIJE

$H = 0$

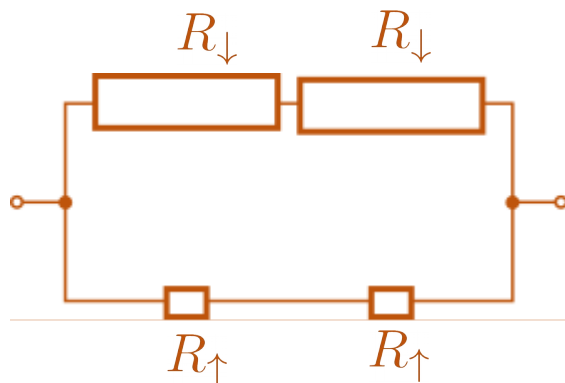
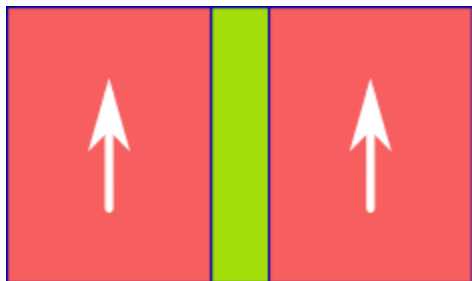


$$\frac{1}{R_{uk}(0)} = \frac{1}{R_{\downarrow} + R_{\uparrow}} + \frac{1}{R_{\downarrow} + R_{\uparrow}}$$

$$\Rightarrow R_{uk}(0) = \frac{R_{\downarrow} + R_{\uparrow}}{2}$$

$$\Delta R_{uk}(0) = R_{uk}(H) - R_{uk}(0) = -\frac{1}{2} \frac{(R_{\uparrow} - R_{\downarrow})^2}{R_{\uparrow} + R_{\downarrow}}$$

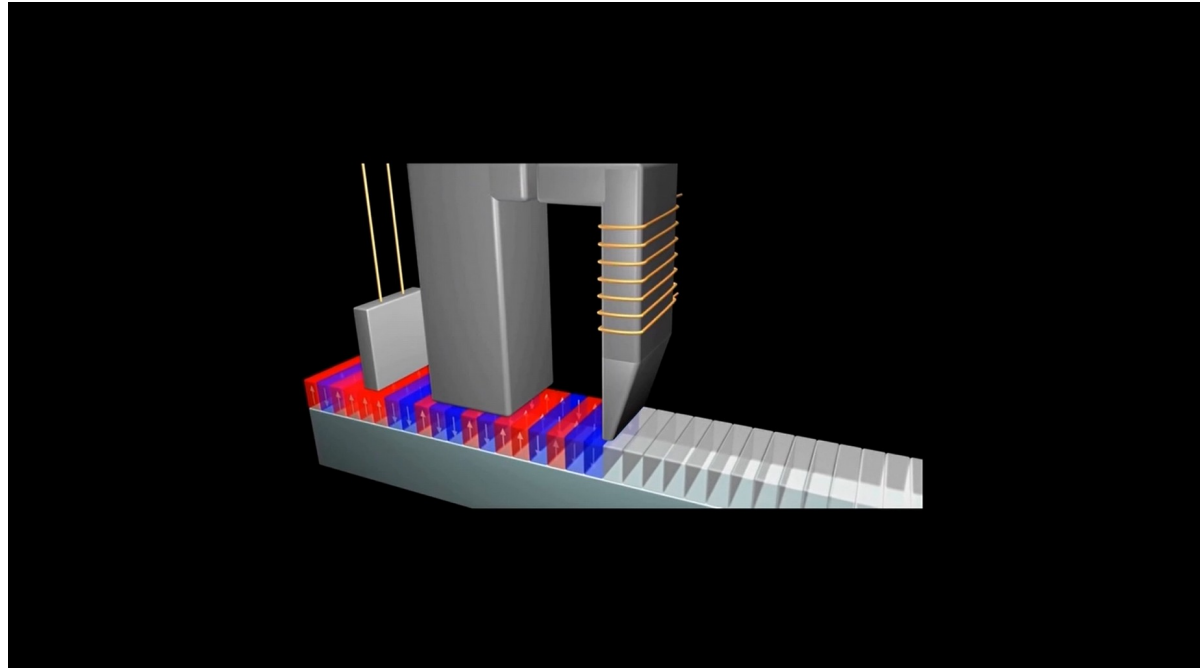
$H \neq 0$



$$\frac{1}{R_{uk}(H)} = \frac{1}{2 R_{\downarrow}} + \frac{1}{2 R_{\uparrow}}$$

$$\Rightarrow R_{uk}(H) = 2 \frac{R_{\downarrow} R_{\uparrow}}{R_{\downarrow} + R_{\uparrow}}$$

RAČUNALNE MEMORIJE



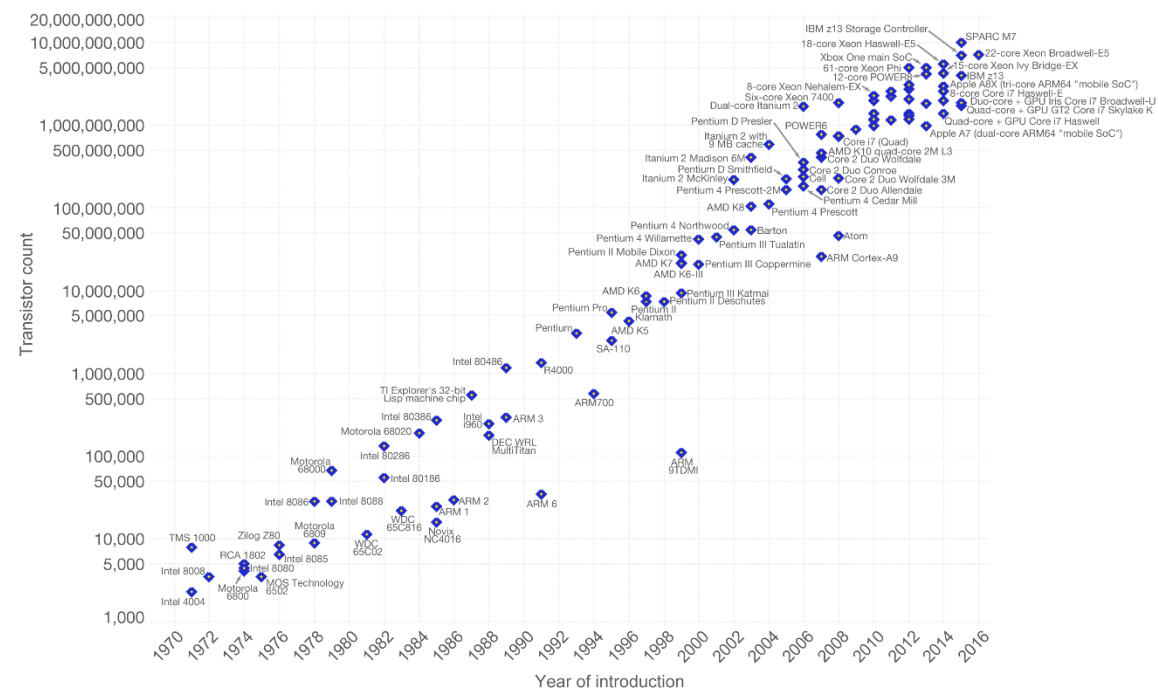
INFORMACIJSKE TEHNOLOGIJE

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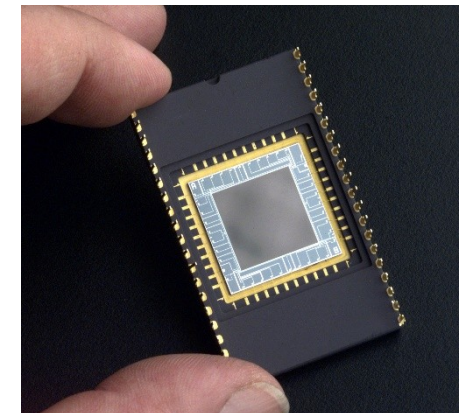
Moore's Law – The number of transistors on integrated circuit chips (1971-2016)

Moore's law describes the empirical regularity that the number of transistors on integrated circuits doubles approximately every two years. This advancement is important as other aspects of technological progress – such as processing speed or the price of electronic products – are strongly linked to Moore's law.



Data source: Wikipedia (https://en.wikipedia.org/wiki/Transistor_count)
The data visualization is available at [OurWorldInData.org](https://ourworldindata.org). There you find more visualizations and research on this topic.

Licensed under CC-BY-SA by the author Max Roser.

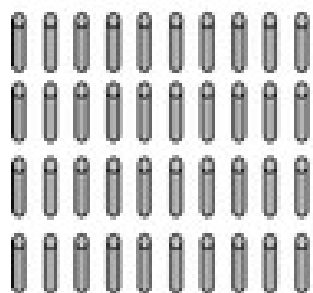


MONITORI I TELEVIZORI

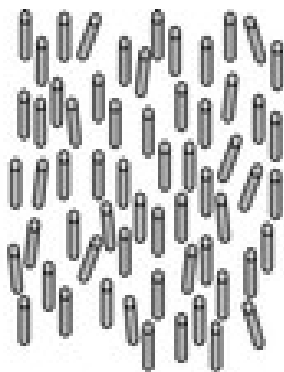
MONITORI I TELEVIZORI

1991. tekući kristali i polimeri

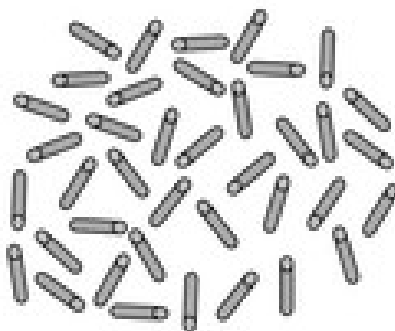
de Gennes



kristal

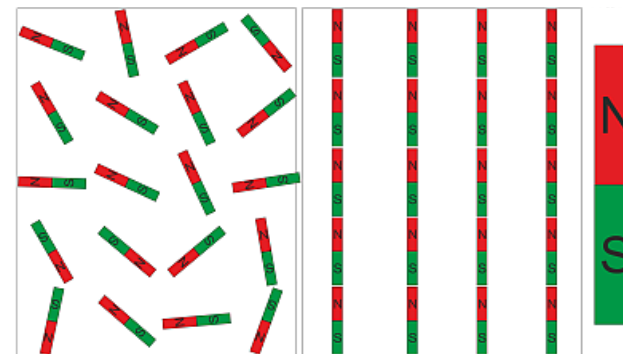
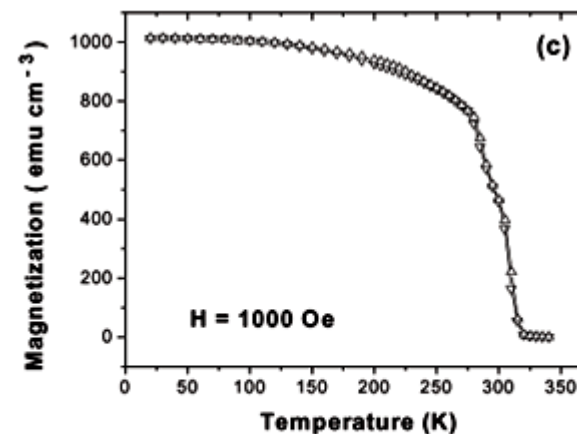


tekući kristal



tekućina

temperatura



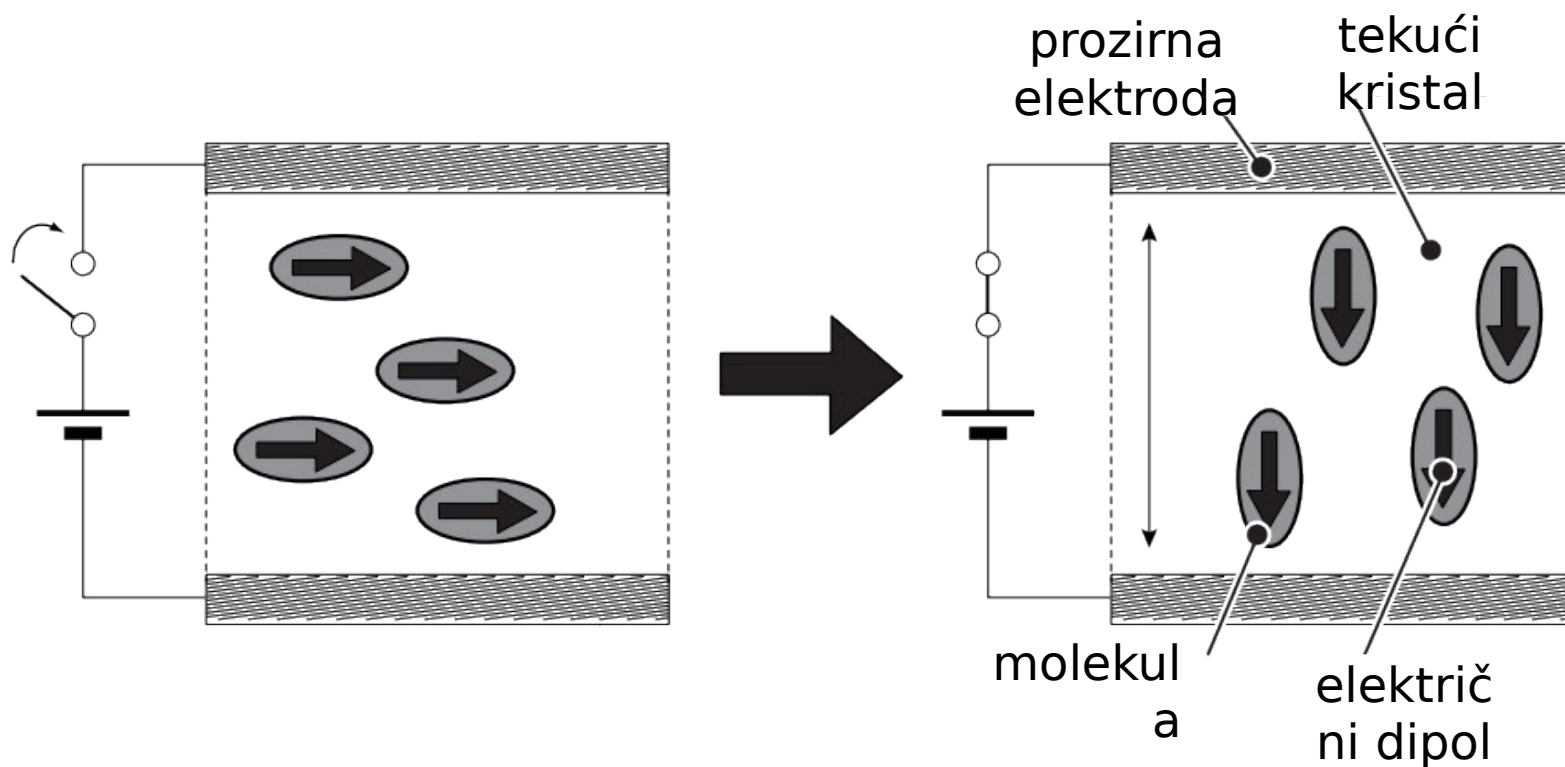
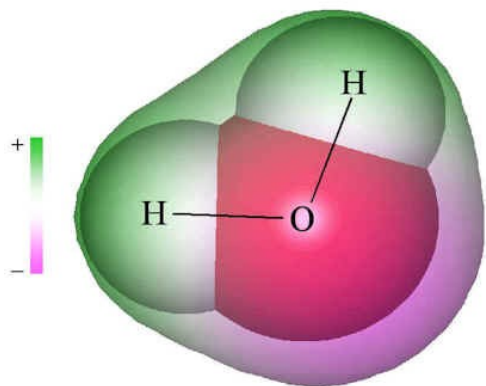
MONITORI I TELEVIZORI

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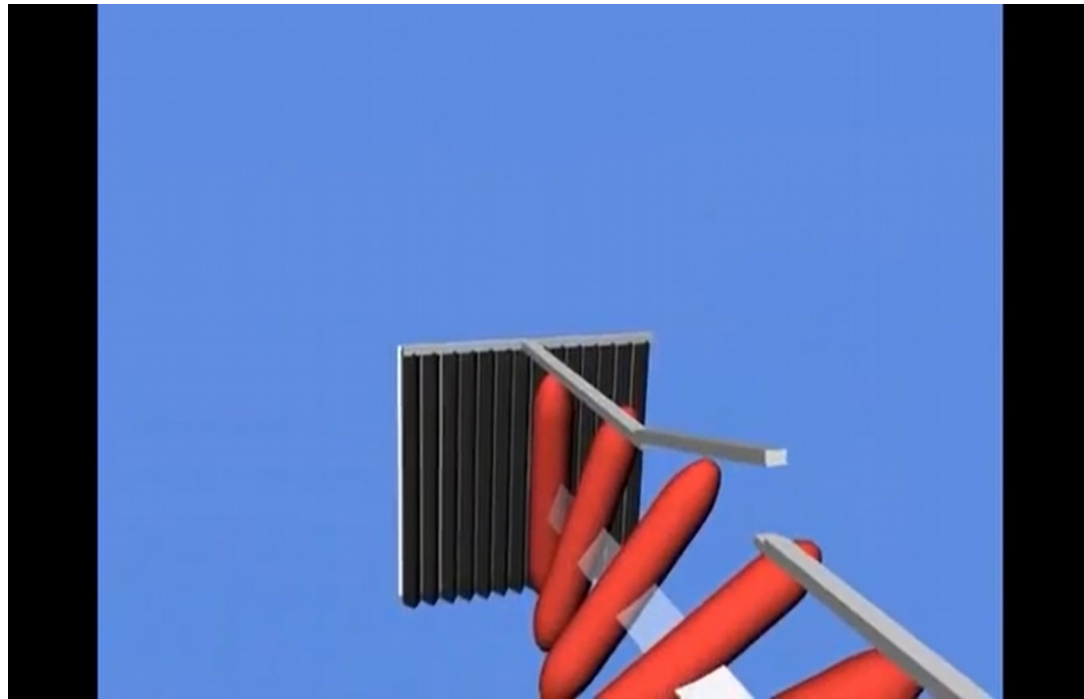
1991. tekući kristali i polimeri

de Gennes

Električni dipol:



MONITORI I TELEVIZORI

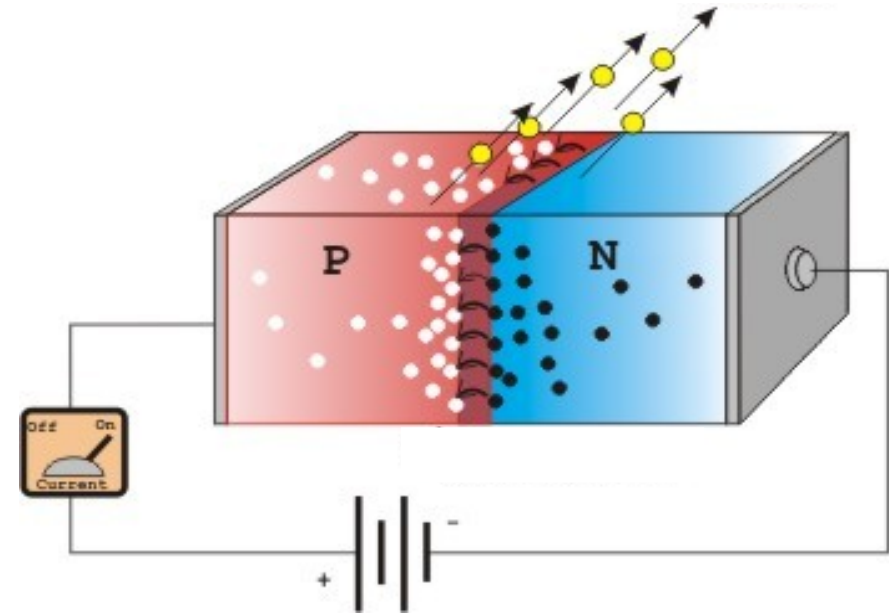
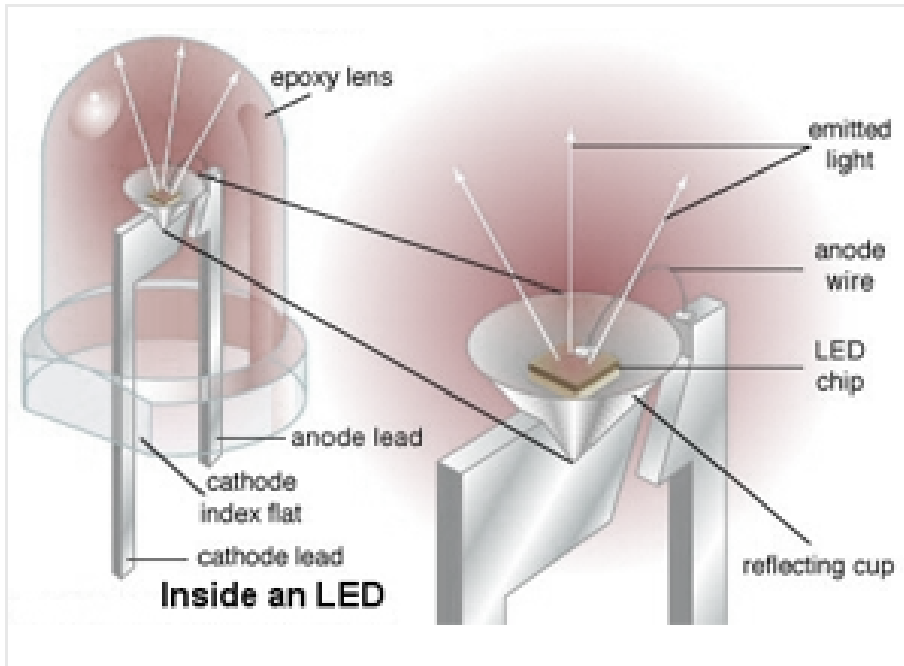


EKOLOŠKA RASVJETA

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2014. plave svjetleće diode

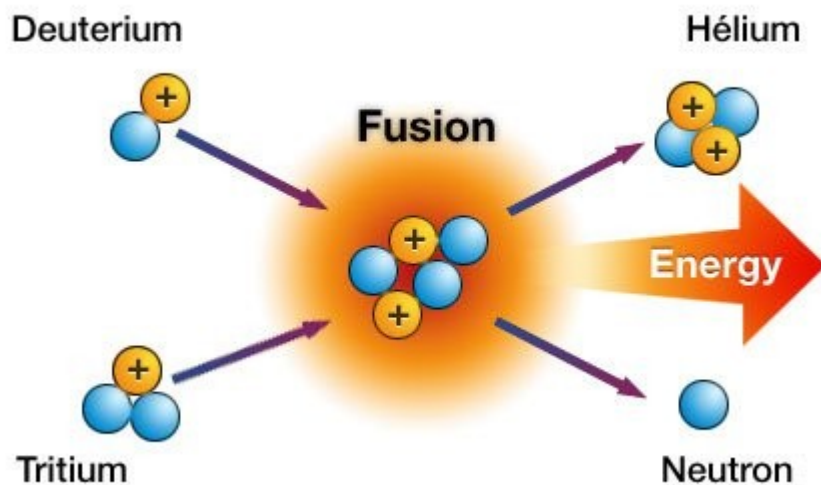
Akasaki, Amano, Nakamura



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$$U = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r}$$

$$q_1 = q_2 = +1,6 \times 10^{-19} \text{ C}$$

$$r = 10^{-15} \text{ m}$$

$$U \sim 10^{10} \text{ K}$$

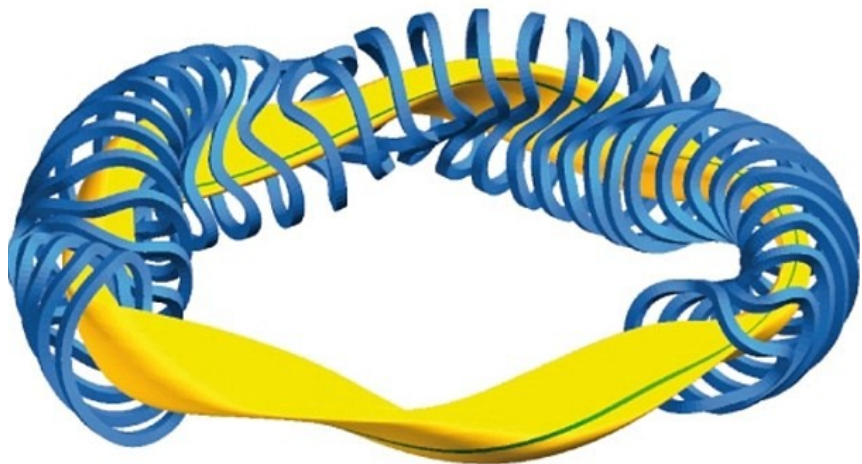
A kolika je temperatura na Suncu?

FUZIJSKI REAKTOR

ТОКАМАК

"тороидальная камера с аксиальным магнитным полем,"

„*toroidal'naya kamera s aksial'nym magnitnym polem*”



NANOTEHNOLOGIJA

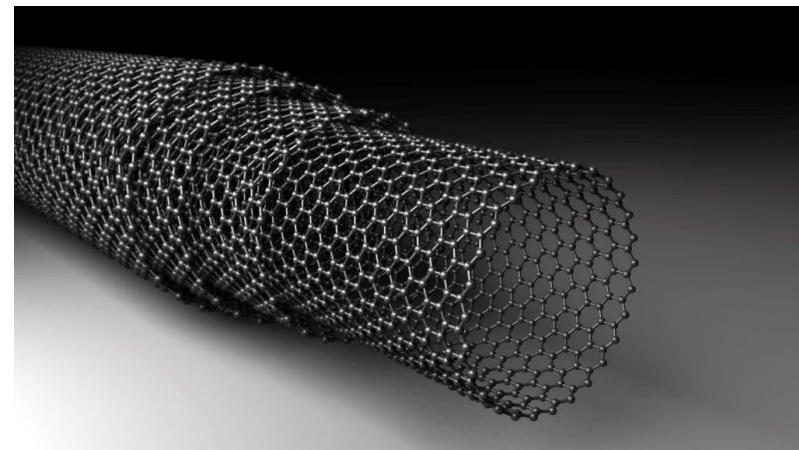
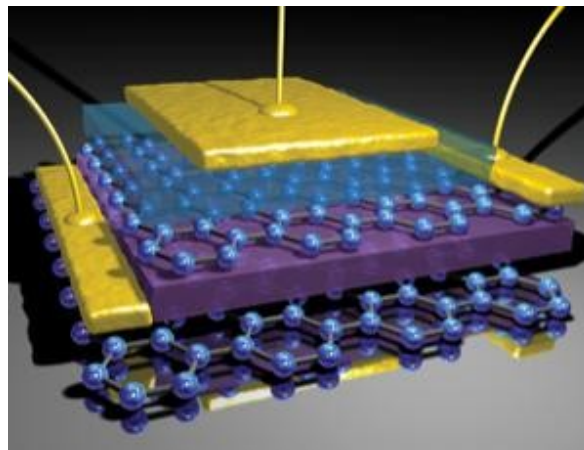
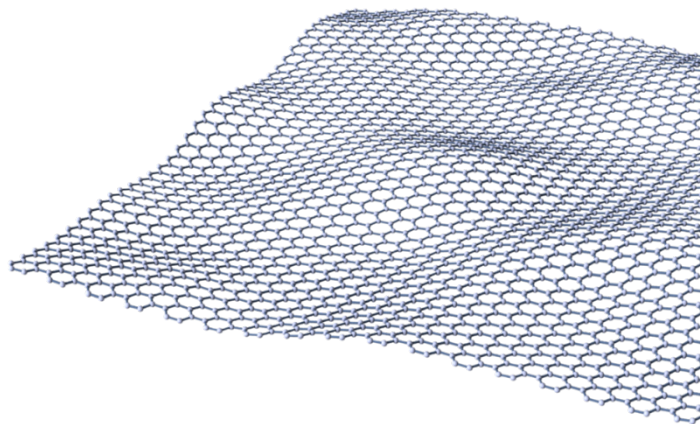
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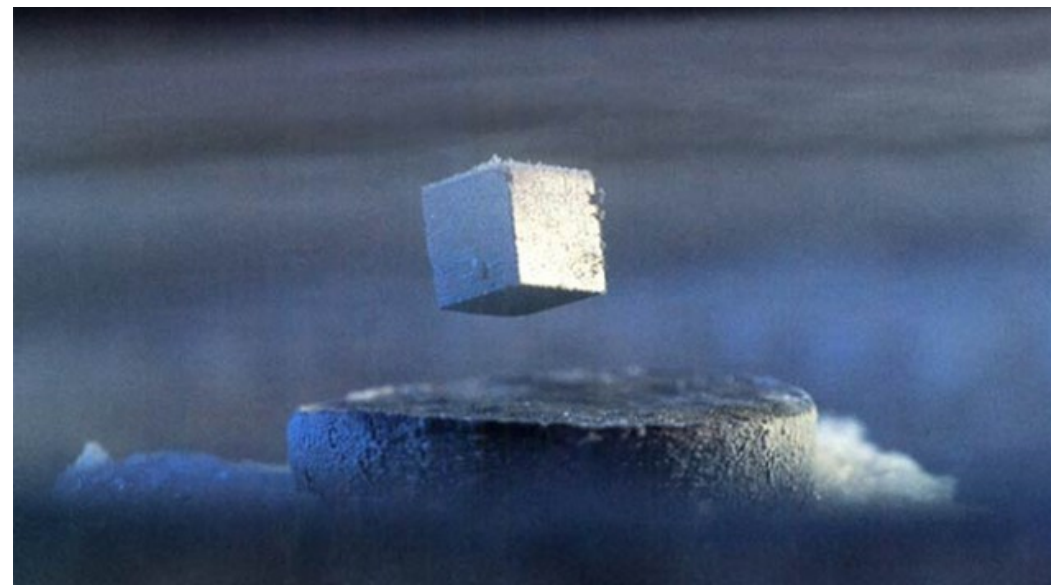
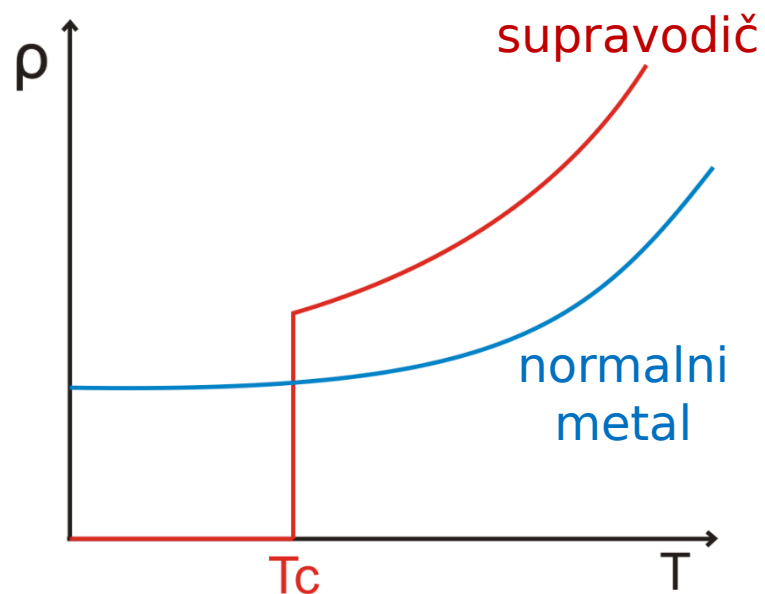
- medicina
- novi materijali
- zamjena za elektroniku (spintronika, kvantna računala)
- ...
- ...



SUPRAVODLJIVOST

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1972.	teorija (klasične) supravodljivosti	Bardeen, Cooper, Schrieffer
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