

Minicurso TikZ

Krissia de Zawadzki

Royal Holloway University of London



Conteúdo

- 1 Introdução
- 2 Elementos básicos
- 3 Diagramas e programação
- 4 Plots e gráficos
- 5 Gambiarras Desenhos aleatoriamente legais
- 6 Concluindo

LaTeX



- ✓ sistema de formatação de documentos com alta qualidade
- ✓ amplamente usado em artigos científicos
- ✓ *Journals* fornecem *documentclass* personalizados

LaTeX



- ✓ amado por físicos



- ✓ sistema de formatação de documentos com alta qualidade
- ✓ amplamente usado em artigos científicos
- ✓ Journals fornecem *documentclass* customizados

Physical Review: revtex-4

PHYSICAL REVIEW LETTERS week ending 29 SEPTEMBER 2017

Scaling of Majorana Zero-Bias Conductance Peaks

Fabrizio Nicolis,^{1,2} Abhijit C. C. Drachman,³ Alexander M. Whitehead,¹ Edie C. T. O’Farrell,¹ Henri J. Suominen,¹ Antonio Formenti,¹ Tim Warburton,^{1,2,4} Geoffrey C. Ginder,^{2,5,6} Caudine Thomas,^{2,7} Anthony T. Hütte,^{2,12} Peter Krogstrup,²

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(Received 20 June 2017; published 29 September 2017)

We report an experimental study of the scaling of zero-bias conductance peaks compatible with Majorana zero modes as a function of magnetic field, tunnel coupling, and temperature in one-dimensional nanowires. The analysis of the scaling behavior reveals a logarithmic-like temperature dependence consistent with theory, including peak conductance that is proportional to tunnel coupling, saturation at $\pi/4$, decreases as expected with field-dependent gap, and collapses onto a single scaling function in the dimensionless ratio of temperature and tunnel coupling.

DOI: 10.1103/PhysRevLett.119.136805

IOP: iopclass

High. Phys. **26** (2016) 48002

<https://doi.org/10.1088/1361-6513/aa49d9>

New Journal of Physics

The open access journal for physics

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View article

ROADMAP

The quantum technologies roadmap: a European community view

Alexander Aalto¹, Immanuel Bloch², Barry Croke³, Thomas Calmer⁴, Christopher Tickler⁵, Denes Barzanjeh², David Ferry², Nicolas Guieu², Stefien Claes⁶, Pedro Reina⁷, Maciej Lewenstein⁸, Max F. Raether⁹, Piotr Olszak¹⁰, Rob Thew¹¹, Andreas Walther¹², Ian Walmsley¹³ and Frank K. Wilhelm¹⁴

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E-mail: jnp@ictp.ac.il

Keywords: quantensystem, quantencomputing, quantenmechanik, quantenmechanics, quantummechanics, quantumcomputer

LaTeX

{TEX}

- ✓ amado por físicos



✗ sintaxe chata
difícil entender os erros
(sem o tex.stackexchange)

- ✓ sistema de formatação de documentos com alta qualidade
- ✓ amplamente usado em artigos científicos
- ✓ Journals fornecem *documentclass* customizados

Physical Review: revtex-4

PHYSICAL REVIEW LETTERS 29 SEPTEMBER 2017

Scaling of Majorana Zero-Bias Conductance Peaks

Fabrizio Nicolo^{1,*}, Ashkan C. C. Drachman¹, Alexander M. Whiston¹, Egor C. T. O'Burn¹, Henri J. Suominen¹, Antonio Formenti¹, Tian Wang^{2,3†}, Geoffrey C. Ginder^{2,3‡}, Conner Thomas^{2,3§}, Anthony T. Haule^{2,3¶}, Peter Krogstrup¹, Michael J. Manfra^{2,3}, Stephan Plautz^{2,3}, and Charles A. Marcus^{1,3}¹

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(Received 20 June 2017; published 27 September 2017)

We report an experimental study of the scaling of zero-bias conductance peaks compatible with Majorana zero modes as a function of magnetic field, tunnel coupling, and temperature in one-dimensional nanowires. Our results are consistent with a mean-field-like approximation. Results are consistent with theory, including peak conductance that is robust to tunnel coupling, saturation at $\sim 25\%$, decreases as expected with field-dependent gap, and collapse onto a single scaling function in the dimensionless ratio of temperature and tunnel coupling.

DOI: 10.1103/PhysRevLett.119.130605

```
Terminal - krisia@monster:~/Dropbox/Pdpano&Kris/minicu - +x
File Edit View Terminal Tabs Help
krisia@mon... x krisia@mon... x krisia@mon... x krisia@mon...
! File ended while scanning use of '\beamer@collect@body'.
<-inserted text>
<par>
<+> minicurso_tikz.tex
?

?

(Please type a command or say '\end')
?
?
?
?
?
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```

IOP: iopclass

MAP Publishing New J. Phys. 20 (2018) 045006

<https://doi.org/10.1088/1367-263X/aad50c>

New Journal of Physics

The open access journal for physics research

ROADMAP

The quantum technologies roadmap: a European community view

Antonio Acosta*, Ignacio Blázquez*, Barry Bakker*, Thomas Calmer*, Christopher Fabrik*, David Forney*, David Hanneke*, Nicolas Guérin*, Steffen J. Gläser*, Pedro J. García*, Maciej Lewenstein*, Max F. Kubis*, Peter Olschentrug*, Rob Thew*, Andreas Wallraff*, Jan Walmsley*, and Frank K. Wilhelm*

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Journal of Physics: Condensed Matter 30 (2018) 375401

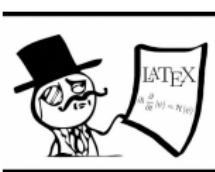
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LaTeX



- ✓ amado por físicos



- ✓ a comunidade melhorou!



- ✓ sistema de formatação de documentos com alta qualidade
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PRL 119, 136805 (2017) PHYSICAL REVIEW LETTERS week ending 29 SEPTEMBER 2017

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Features & Benefits

IOP Publishing New J. Phys. 20(2018) 085006

<https://doi.org/10.1088/1367-2630/aad504>

IOP: iopclass

New Journal of Physics

The open access journal where physics meets

Publons | CrossMark | Impact Factor | CiteScore | IF | Dimensions | Google Scholar | Scopus | Web of Science | Publons | CrossMark | Impact Factor | CiteScore | IF | Dimensions | Google Scholar | Scopus | Web of Science

ROADMAP

The quantum technologies roadmap: a European community view

Alexander Albrecht,¹ Stephan Blöcker,² Barry Bakker,³ Thomas Caleno,⁴ Christiane Fließner,⁵

David Fornari,⁶ Nicolas Gisin,⁷ Pedro Gómez,⁸ Stefan Kuhn,⁹ Maciej Lewenstein,¹⁰ Max F. Raether,¹¹ Piet O. Schmidt,¹² Rob Thew,¹³ Andreas Wallraff,¹⁴ Ian Walmsley,¹⁵ Frank K. Wilhelm,¹⁶ and Jörg Wiersig¹⁷

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Formal Letter

{TikZ} PGF plots

- ✓ combinam recursos TeX para gráficos de alta qualidade: vetorial
- ✓ sintaxe intuitiva
- ✓ documentação recheada de exemplos

{TikZ} PGF plots

- ✓ combinam recursos TeX para gráficos de alta qualidade: vetorial
- ✓ sintaxe intuitiva
- ✓ documentação recheada de exemplos

TEXample.net }

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TIKZ Community Weblog

Examples Resources Builds Questions

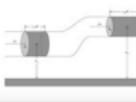
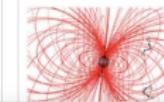
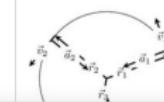
Home > TIKZ > Examples > Technical area: Physics

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Physics examples

 Animated Wankel-Motor [PDF] [TEX]	 Rigid body dynamics • Circular motion • Translational motion • Complex motion [PDF] [TEX]	 Clusters of atoms [PDF] [TEX]
		

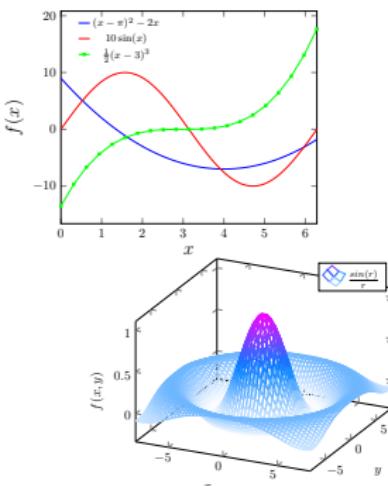
Features

Absolute positioning	4
Angles	1
Arcs	4
Arrows	18
Automata and Petri nets	5
Background	12
Blending	2
Calendar library	5
Calculus	1
Chains	12
Circuits	3
Clipping	18
Coordinate calculations	99

TikZ e PGF

{TikZ} PGF plots

- ✓ formas pré-definidas
- ✓ suporte para gráficos 2D, 3D



- ✓ combinam recursos TeX para gráficos de alta qualidade: vetorial
- ✓ sintaxe intuitiva
- ✓ documentação recheada de exemplos

TeXample.net }

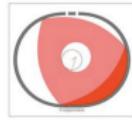
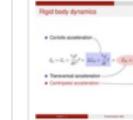
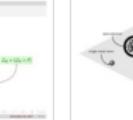
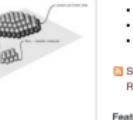
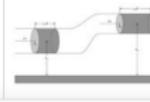
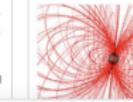
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Physics examples

 <p>Rigid body dynamics • Gentle acceleration • Thermal acceleration • Complex acceleration</p>	 <p>Animated Wankel-Motor [PDF] [TEX]</p>	 <p>Beamer arrows [PDF] [TEX]</p>
 <p>Clusters of atoms [PDF] [TEX]</p>		 <p>Blending • Absolute positioning • Angles • Arcs • Arrows • Automata and Petri nets • Background • Blending • Calendar library • Calouts • Chains • Circuits • Clipping • Coordinate calculations</p>

Navigation

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Features

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Coordinate calculations	99

Instalação

Dependências

- ➡ xcolor
- ➡ xkeyval

...

pdftex

...

gnuplot (gráficos)

...

animações



recomendado

```
sudo apt-get install texlive-latex-extra
```

```
sudo apt-get install texlive-pictures
```

```
texlive-pstricks
```

pra tudão

```
sudo apt-get install texlive-full
```

Piece of cake I

TeX Live



use: MikTeX package manager

Piece of cake II

Overleaf



use: Tex Live Utility

Quick start

✓ conexão LaTeX: header e environments

```
tty: /bin/bash
```

```
krissia@mapomme$ vim desenhoTikZ.tex
\documentclass {standalone}
\usepackage{tikz}
```

✓ compilação: pdflatex

```
\documentclass []{standalone}
```

```
\usepackage{tikz}
```

```
\begin{document}
```

```
\begin{tikzpicture}
```

```
\end{tikzpicture}
```

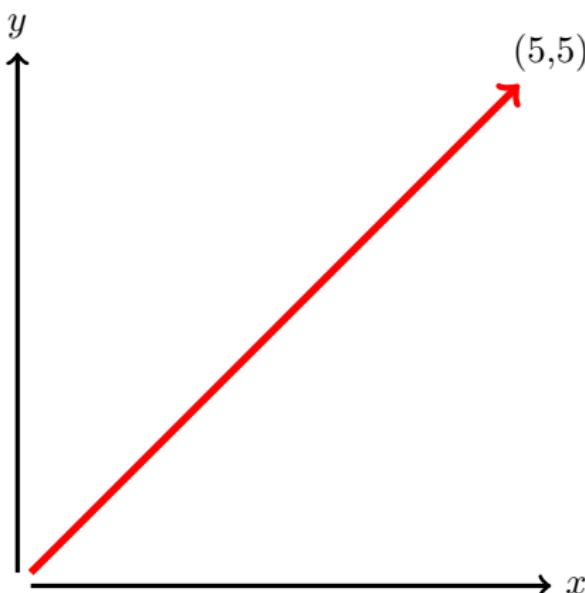
```
\end{document}
```

Arroz com feijão

- sistemas de coordenadas em 2D e 3D
- coordenadas relativas
- pontos e retas
- caminhos
- nós e formas pré-definidas
- sombras

Sistema de Coordenadas: 2D

✓ orientação cartesiana



$x : (1,0)$
 $y : (0,1)$

✓ coordenadas

```
\coordinate (meuponto) at  
(x0, y0);
```

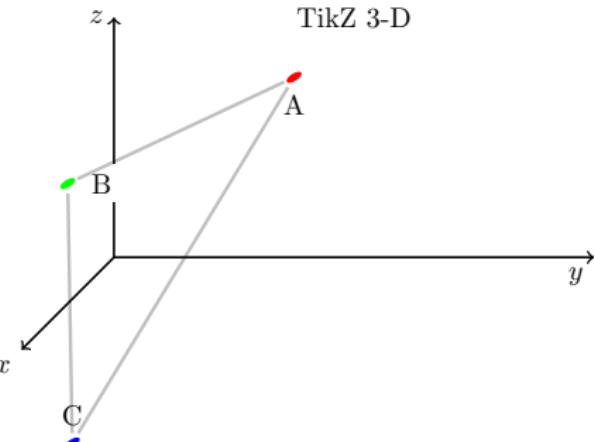
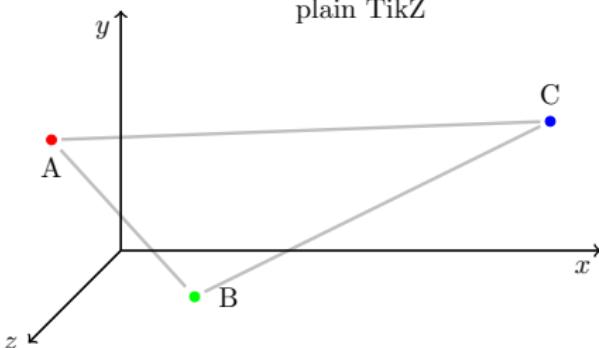
Sistemas de Coordenadas: 3D

✓ orientação TikZ

$$\begin{aligned}x &: (1,0,0) \\y &: (0,1,0) \\z &: (0,0,1) \rightarrow \text{profundidade}\end{aligned}$$

✓ orientação tikz-3dplot

$$\begin{aligned}x &: (1,0,0) \rightarrow \text{profundidade} \\y &: (0,1,0) \rightarrow x\text{-2D} \\z &: (0,0,1) \rightarrow y\text{-2D}\end{aligned}$$



Coordenadas relativas

```
\usetikzlibrary{calc}
```



```
\coordinate (origem) at (0,0);  
  
\coordinate (coordenada2) at ($(origem) + (xshift, yshift)$);
```

Pontos

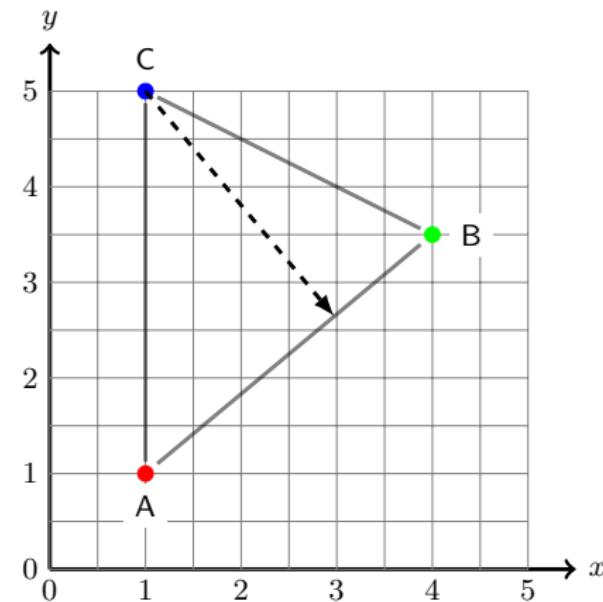
✓ pontos no plano

```
\filldraw [cor] (x,y) circle  
(raio);
```

```
\filldraw[cor] (x,y) circle  
(0.08cm) node (nome-ponto)  
node[anchor=north,  
fill=cor, yshift=ys cm,  
text=cor, font=familia ] {  
texto};
```

✓ pontos em 3D

```
\filldraw [cor] (x,y,z) circle  
(raio);
```



Retas e pontos

Retas

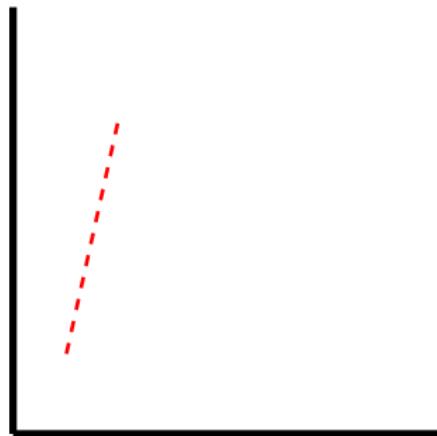
✓ reta no sistema de coordenadas 2D

```
\draw[keywords set] (x0, y0) -- (xf, yf);
```

```
\draw[keywords set] (x0, y0) -- (xf, yf)
[text options] { texto } ;
```

line width
color
dashed
bend
rotate
->, latex arrows

font
text width
color



Retas

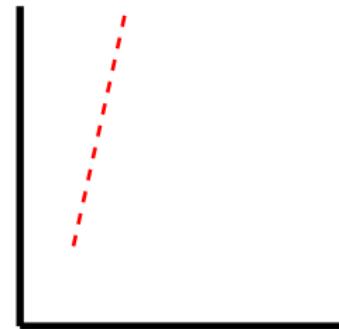
```
\begin{tikzpicture}
\coordinate (origemXY) at (0,0);
\coordinate (eixoY) at (0,4cm);
\coordinate (eixoX) at (4cm,0);

\draw[line width=2pt] (origemXY) -- (eixoX);
\draw[line width=2pt] (origemXY) -- (eixoY);

\coordinate (iniciodareta) at (0.5cm,0.75cm);
\coordinate (fimdareta) at (1cm,3cm);

\draw[line width=1pt, red, dashed]
(iniciodareta) -- (fimdareta);

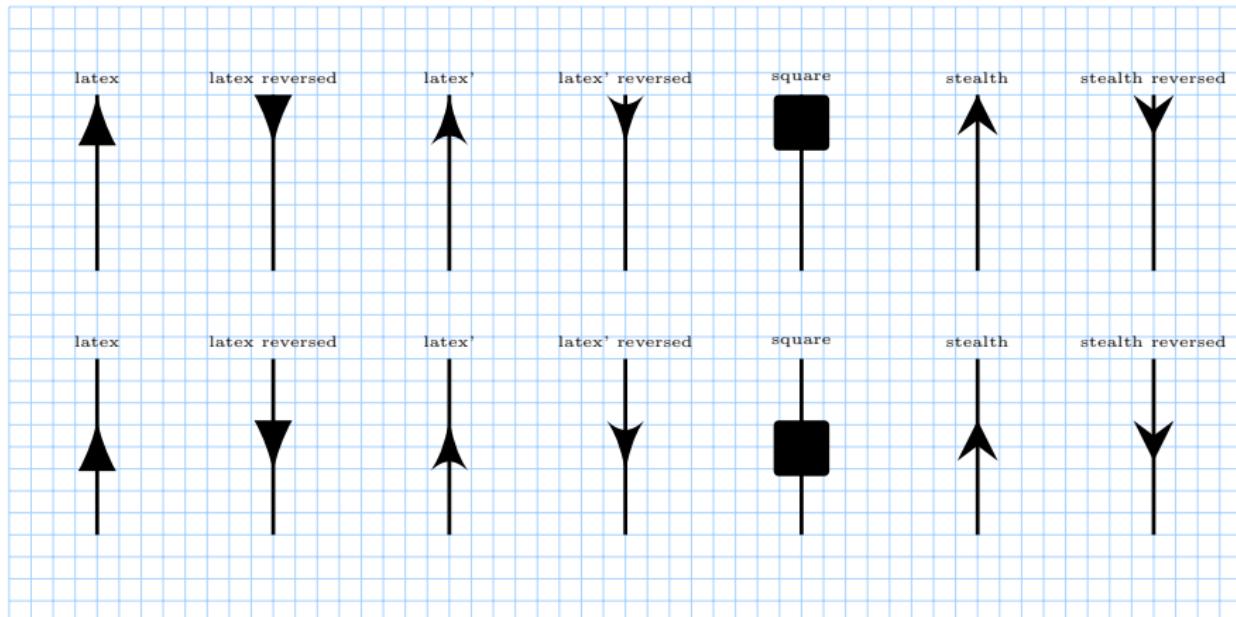
\end{tikzpicture}
```



Retas e pontos

Retas: setas

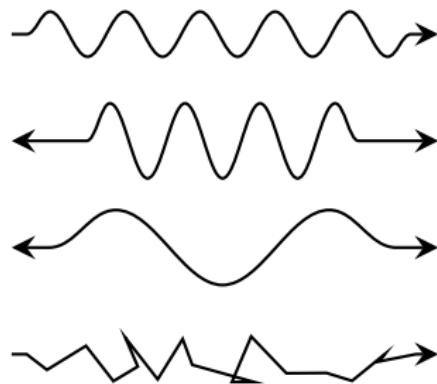
- ✓ vetores podem ser desenhados como nós ou retas com markers no fim
- ✓ diversos tipos de seta
- ✓ controle da posição da seta



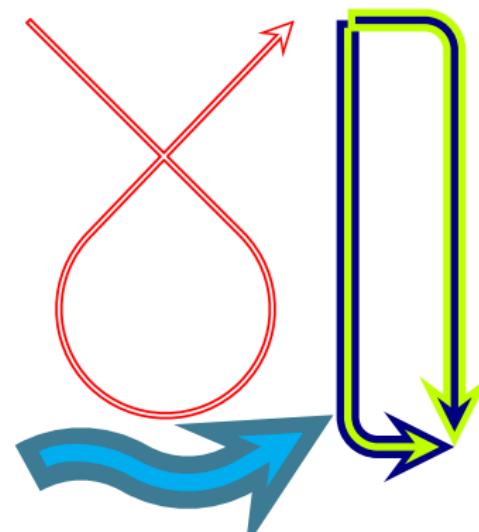
Retas e pontos

Retas: setas

➡ recursos de decoração



➡ setas combinadas com curvas



Retas e pontos

Retas: setas

```
\usetikzlibrary{arrows, arrows.meta}
```

\draw[->] (p1) -- (p2); 

\draw[-stealth] (p1) -- (p2); 

\draw[-latex, dashed] (p1) -- (p2); 

\draw[-Latex, dotted] (p1) -- (p2); 

\draw[-Latex[length=5mm, width=2mm]]
(p1) -- (p2); 

\draw[-Latex[color=maincolor, length=2.5mm,
width=2mm], line width=1.5pt]
(p1) -- (p2); 

Mais em: <https://latexdraw.com/exploring-tikz-arrows/>

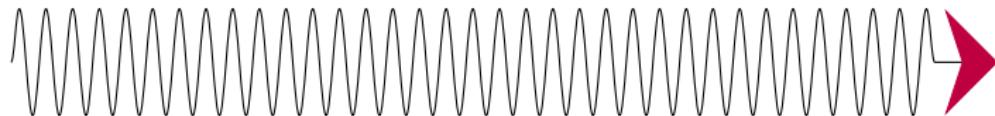
Retas: decorações

```
\usetikzlibrary{snakes}
```

```
\draw[->, snake=snake] (p1) -- (p2);
```



```
\draw[-Stealth[color=purple, length=5mm, width=10mm],  
snake=snake, segment amplitude=5mm, segment  
length=2.5mm, line after snake=5mm] (p1) -- (p2);
```



Retas: decorações

```
\usetikzlibrary{decorations, decorations.pathmorphing}
```

```
\draw[decorate, draw=magenta,  
decoration={coil, amplitude=4pt, segment  
length=5pt}] (p1) -- (p2);
```



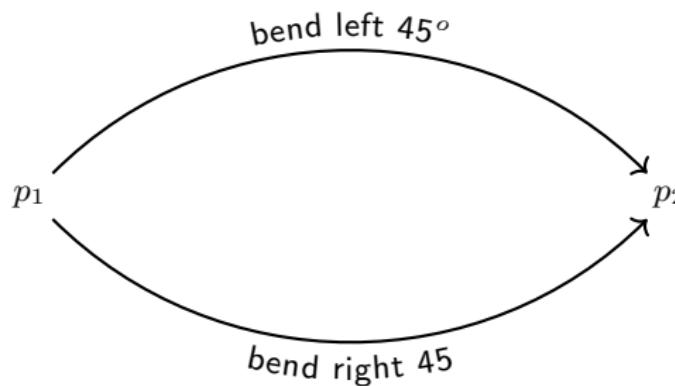
```
\draw[draw=blue, postaction={decorate},  
decoration={markings, mark=at position .55 with {  
 \arrow [draw=blue]{>}}}] (p1) -- (p2);
```



Retas: decorações

```
\usetikzlibrary{decorations.text}
```

```
\draw[->, postaction={decorate, decoration={text along path,  
text={bend left}}}] (p1) to [bend L/R=angulo] (p2);
```



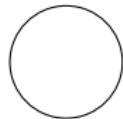
OBS: para usar math mode, precisa usar chaves. Ex: \${ \backslash alpha }\$!

Caminhos fechados e abertos

✓ fechado \draw[] (p1) -- (p2) -- . . . -- (pN) -- (p1);



✓ circulo \draw[] (p1) circle (raio);



✓ elipse \draw[] (p1) ellipse (rmaior, rmenor);



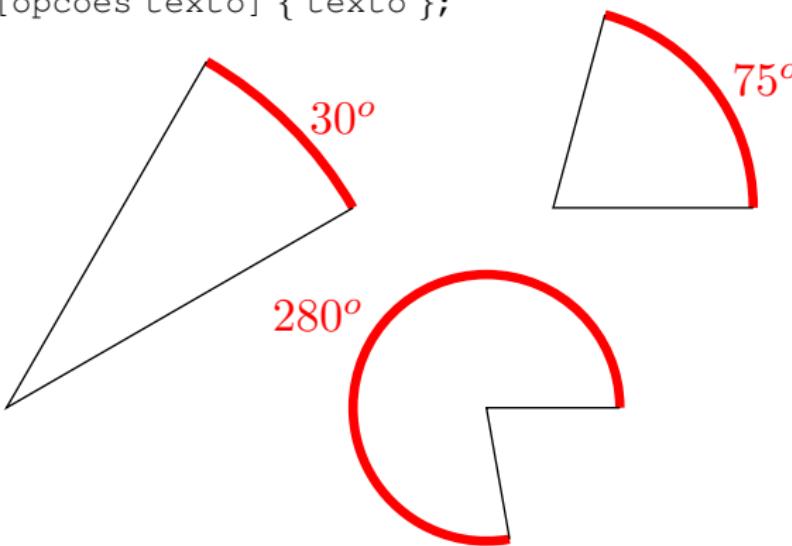
✓ retangulo \draw[] (p1) rectangle (p2);



Caminhos: arcos de circunferência

✓ arcos são bastante versáteis

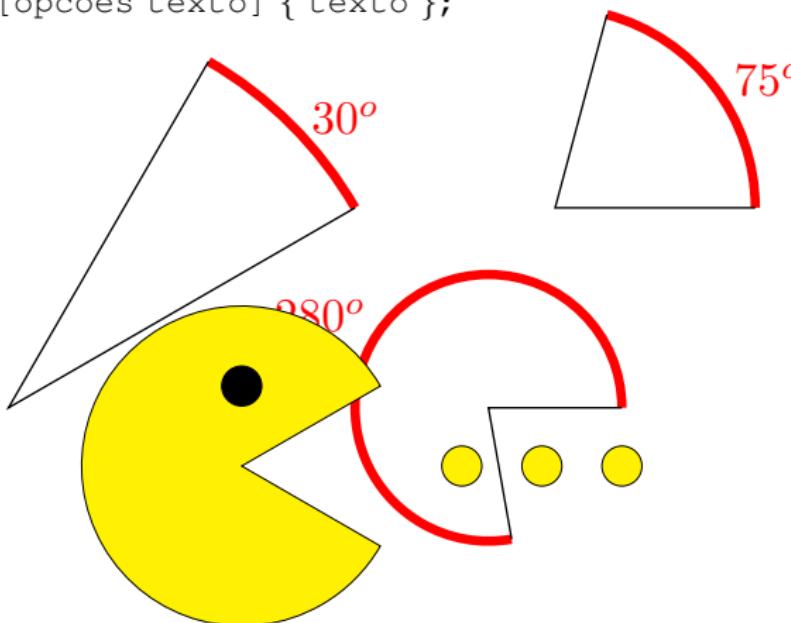
```
\draw [opcoes desenho] (coord) arc (angulo1:angulo2:raio) node  
[opcoes texto] { texto };
```



Caminhos: arcos de circunferência

✓ arcos são bastante versáteis

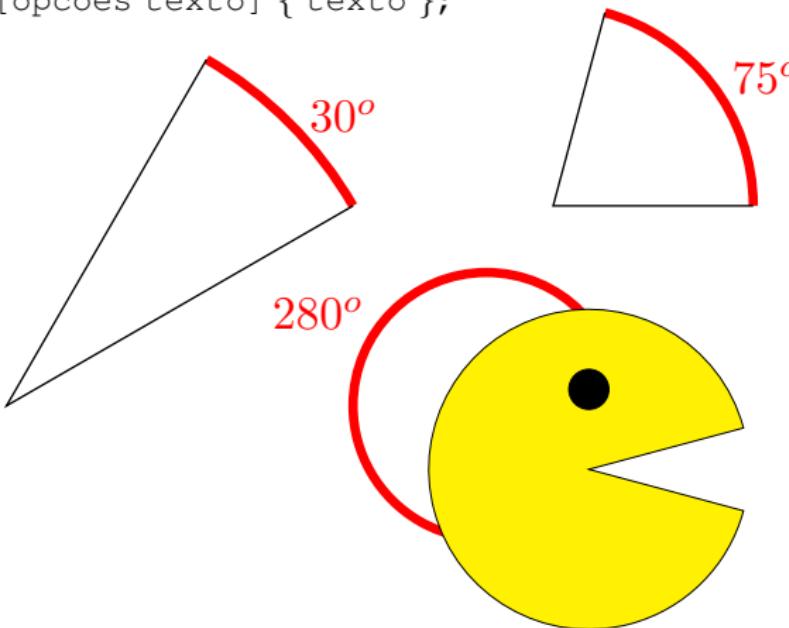
```
\draw [opcoes desenho] (coord) arc (angulo1:angulo2:raio) node  
[opcoes texto] { texto };
```



Caminhos: arcos de circunferência

✓ arcos são bastante versáteis

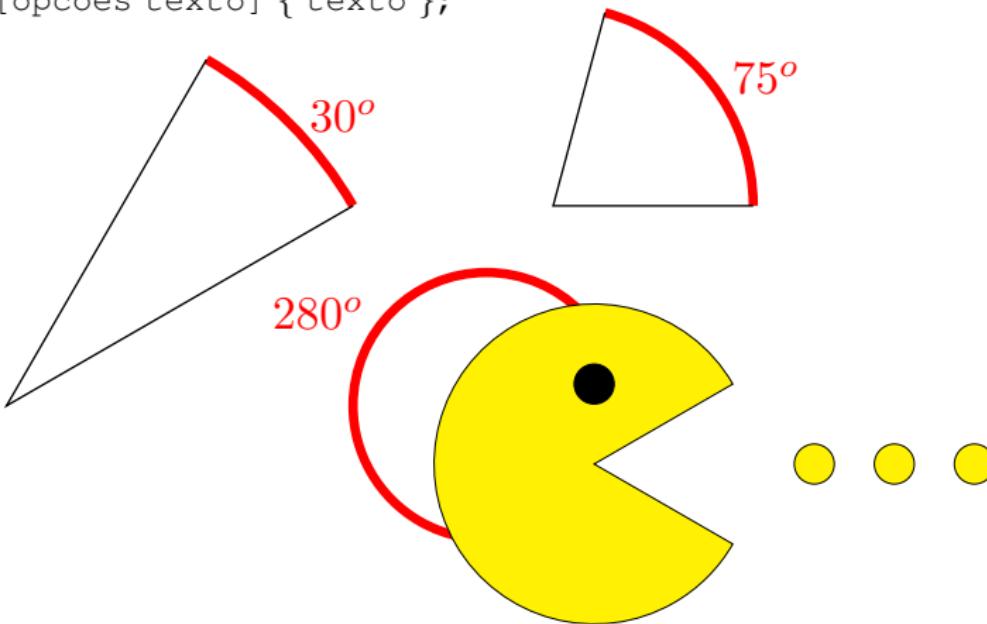
```
\draw [opcoes desenho] (coord) arc (angulo1:angulo2:raio) node  
[opcoes texto] { texto };
```



Caminhos: arcos de circunferência

✓ arcos são bastante versáteis

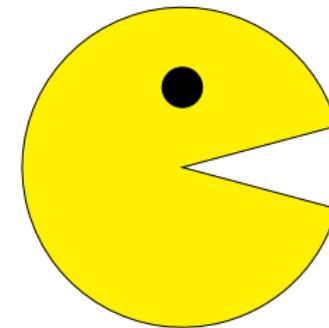
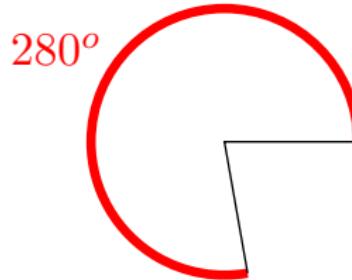
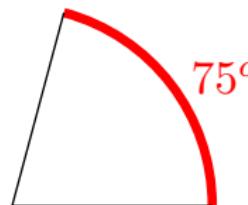
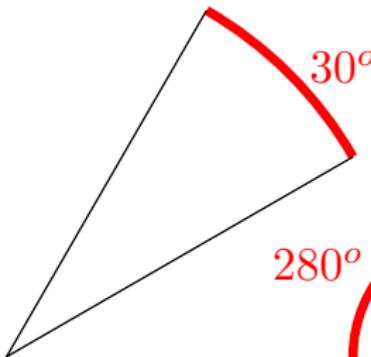
```
\draw [opcoes desenho] (coord) arc (angulo1:angulo2:raio) node  
[opcoes texto] { texto };
```



Caminhos: arcos de circunferência

✓ arcos são bastante versáteis

```
\draw [opcoes desenho] (coord) arc (angulo1:angulo2:raio) node  
[opcoes texto] { texto };
```



Nós

```
\usetikzlibrary{shapes}
```

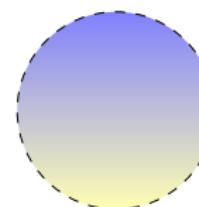
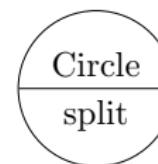
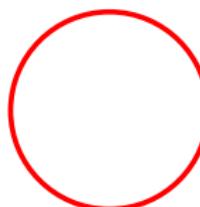
- ✓ várias formas pré-implementadas: polígonos, cônicas, setas, estrelas

ps: mesma forma pode ser desenhada de várias maneiras

Rectangle



circle



ellipse



Nós

- ✓ Nós são a forma mais fácil para desenhar formas

```
\node[forma, keywords set] (nome-do-no) at (posicao) {texto};
```

rectangle: minimum width, minimum height

ellipse

forbidden sign

diamond

strike out

circle: minimum size

regular polygon: regular polygon sides

star: star points

- ✓ anchor: opção para posicionamento! N,S,E,W e/ou NW, NE, SE, SW

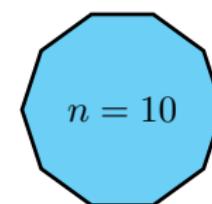
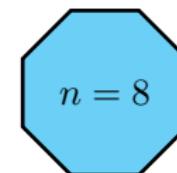
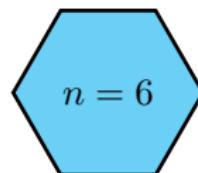
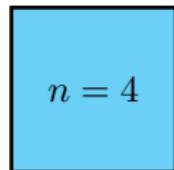
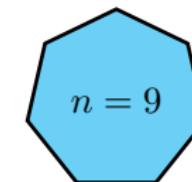
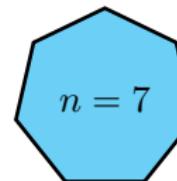
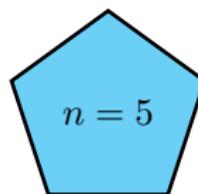
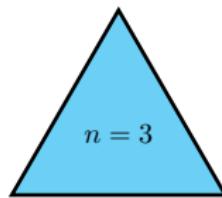
- ✓ dá pra complicar a estrutura com nós de formas diferentes



Polígonos regulares e estrelas

✓ polígonos regulares

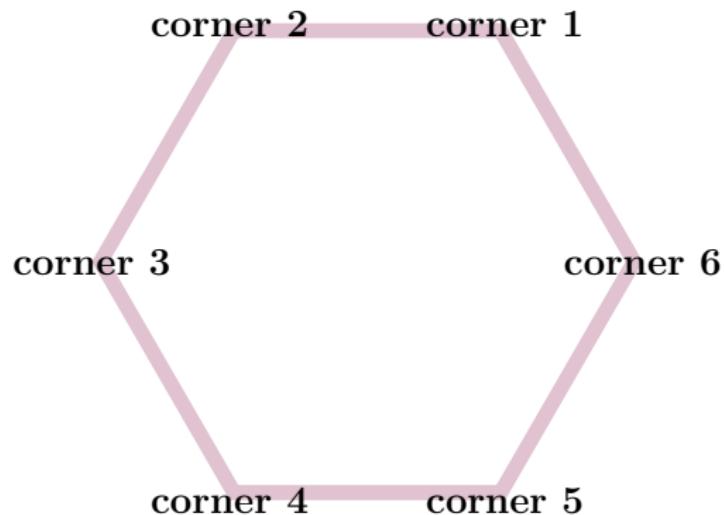
```
\node[regular polygon, regular polygon sides=numero de lados,  
keywords] {texto};
```



Polígonos regulares e estrelas

✓ é possível acessar as coordenadas relativas de vértices

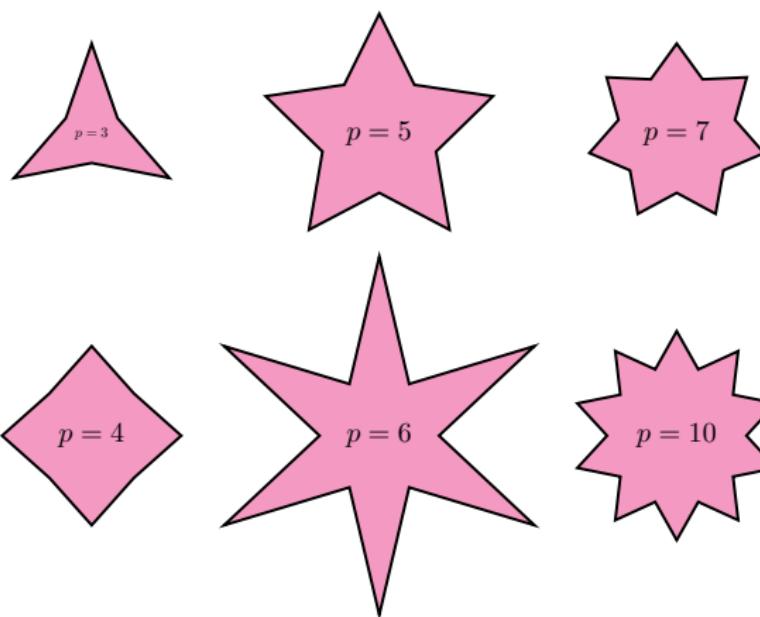
```
\node[regular polygon, regular polygon sides=L] at (coordenada)  
(polygongnode) ;  
(polygongnode.center)  
(polygongnode.corner 1) ...  
(polygongnode.corner L)
```



Polígonos regulares e estrelas

✓ estrelas

```
\node [star, star points=numero de pontas, star point ratio=escala das pontas] { texto };
```



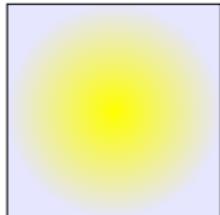
Sombras



```
\shade[top color=cyan, bottom color=black]  
(p1) rectangle +(dx, dy)
```



```
\shade[left color=red, right color=blue]  
(p1) rectangle +(dx, dy)
```



```
\shadedraw[inner color=yellow, outer  
color=blue!10, draw=black]  
(p1) rectangle +(dx, dy)
```



```
\shade[ball color=green]  
(p1) circle (raio)
```

Exercícios

Exercício 1

Desenhe um semáforo usando

- nós
- coordenadas relativas
- sombras



TikZ style e tikzset: definindo suas formas

✓ estilo: definir uma forma recorrentemente usada

➡ específica na figura

➡ global no documento

```
\begin{tikzpicture}[  
    meuestilo/.style={  
        rectangle, draw=white,  
        fill=black, very thick,  
        inner sep=2mm,  
        font=\ttfamily,  
        text=white  
    }  
]  
  
\end{tikzpicture}
```

```
\tikzstyle meuestilo=[  
    rectangle, draw=white,  
    fill=black, very thick,  
    inner sep=2mm,  
    font=\ttfamily, text=white  
]
```

```
\begin{tikzpicture}
```

```
\end{tikzpicture}
```

✓ o código fica mais limpo

✓ conveniente para diagramas e figuras complicadas

TikZ style e tikzset: definindo suas formas

✓ customizações globais

```
\tikzset{  
    place/.style={circle,draw=blue,fill=blue,thick,  
        minimum size=6mm},  
    transition/.style={rectangle,draw=black,fill=black!20,  
        thick,minimum size=4mm}  
}
```

```
\begin{tikzpicture}  
    \node[place] (waiting-1) at (0,2) {};  
    \node (critical-1) at (0,1) [place] {};  
    \node (semaphore) at (0,0) [place] {};  
    \node (leave-critical) at (1,1) [transition] {};  
    \node (enter-critical) at (-1,1) [transition] {};  
  
\end{tikzpicture}
```

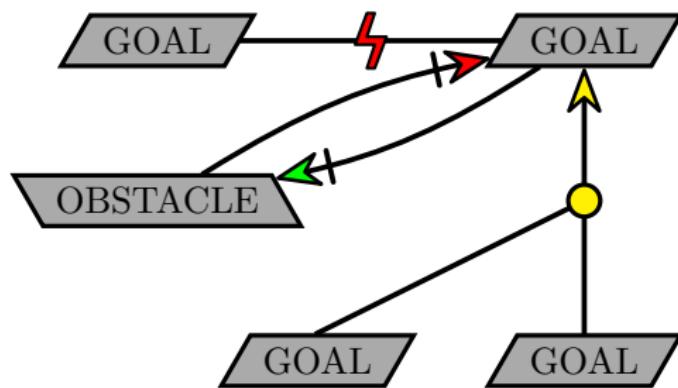
TikZ style e tikzset: definindo suas formas

- ✓ customizações locais

```
\begin{tikzpicture} [mystyle/.style={rectangle, fill=yellow}]  
  
    \node[mystyle] (teste) at (0,0) {Test};  
  
\end{tikzpicture}
```

Diagramas

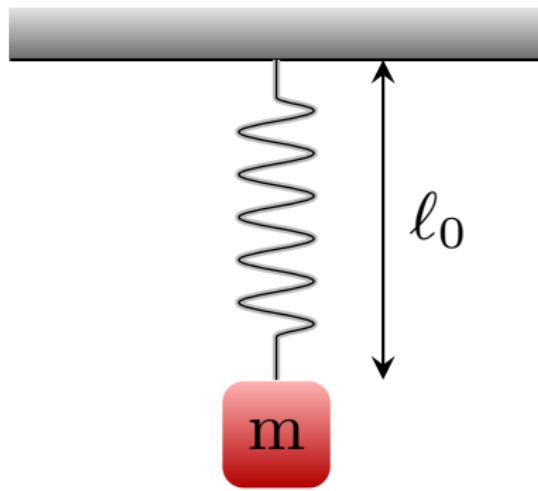
- ✓ coordenadas + tikzstyles + posições relativas
- ✓ diagramas ficam mais fáceis



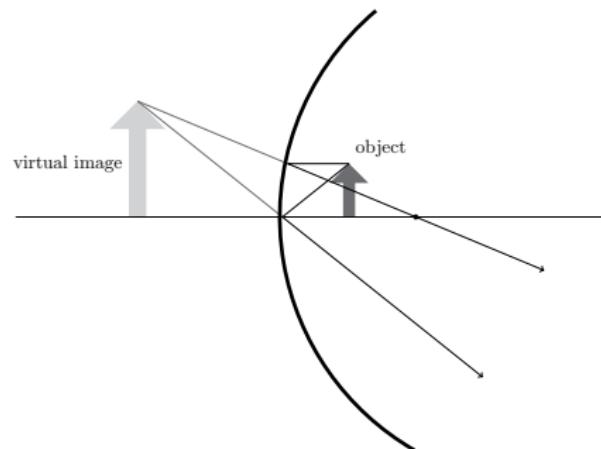
```
\usetikzlibrary{calc}
...
mynode/.style={opcoes}
...
anchor =
east, west, north, south
...
($ (nodename) + (x, y) $)
```

Diagramas e desenhos de Física

Ex: Sistema massa-mola

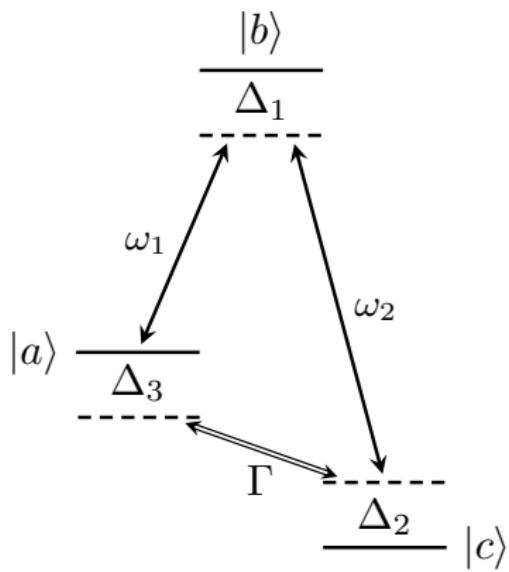


Ex: Óptica básica

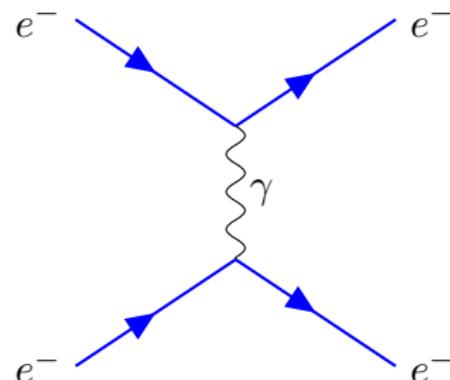


Diagramas e desenhos de Física

Ex: Níveis de energia



Ex: Diagramas de Feynman



Exercícios

Exercício II

Desenhe um sistema massa-mola acoplado usando

- nós
- coordenadas relativas
- snakes/decoration



Codando com TikZ



- ✓ Estruturas de repetição são ultra convenientes para físicos!
- ✓ limpa o código e torna tudo mais fácil
- ✗ a sintaxe para contas mais ousadas é intimidante

Ex: Desenhar um sistema de massas acopladas



```
foreach  
if, then, else  
pgfmathparse
```

Loops: foreach

```
\begin{tikzpicture} [massa/.style={circle, minimum size=0.75cm,
    inner color=blue, outer color=black!10, color=white},
mola/.style={red,decorate,decoration={coil,aspect=0,
    amplitude=2.5mm, segment length=1.5mm,post length=0.5mm}}]

\def \L{7}
\coordinate (origemSiS) at (0,0);

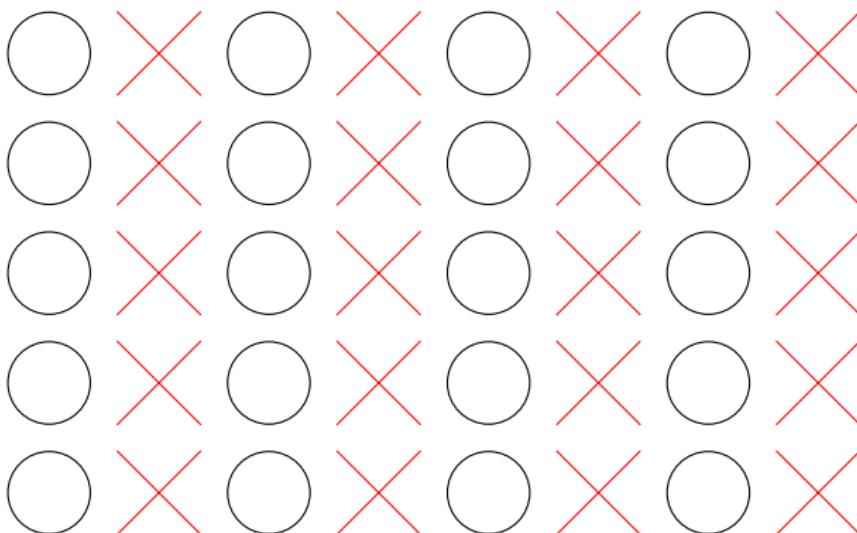
\foreach \x [count = \xi] in {1,...,\L}{%
    \node[anchor=west, massa] (no-\x) at
        ($ (origemSiS.east) + (1.5*\x,0) $) {\x};
}

\foreach \xR [count = \xL from 1] in {2,...,\L}{%
    \draw[anchor=west, mola]
        ($ (no-\xL.east) $)--($ (no-\xR.west) $) ;
}

\end{tikzpicture}
```

Aritmética com variáveis

Exemplo: bolinhas e cruzes intercaladas: par/ímpar



Aritmética com variáveis

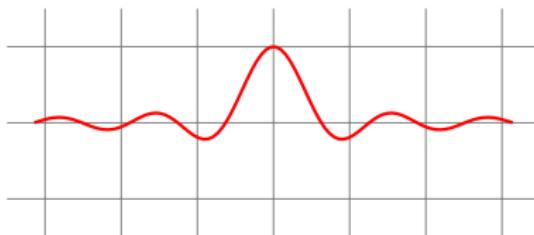
```
\begin{tikzpicture}
\def\r{0.75cm}
\tikzset{
    bolinha/.style={circle, minimum size=\r, draw=black},
    quadrado/.style={cross out, minimum size=\r, draw=red} }

\foreach \x in {1,...,8}{\foreach \y in {1,...,5} {
    \pgfmathparse{int(mod(\x,2))}%
    \pgfmathsetmacro{\parouimpar}{\pgfmathresult}
    \xdef\parouimpar{\parouimpar}
    \ifnum \parouimpar = 1{
        \node[anchor=center, bolinha] (no-\x-\y) at (\x,\y) {};
    }
    \else{
        \node[anchor=center, quadrado] (no-\x-\y) at (\x,\y) {};
    }
    \fi
}}
\end{tikzpicture}
```

Funções

```
\begintikzpicture[declare function={minhafunc(\x)= sin(\x)}]
```

```
\usetikzlibrary{math}
```



```
\tikzmath{
    function sinc(\x) {
        if abs(\x) < .001 then {
            return 1;
        } else {
            return sin(\x r)/\x;
        };
    };
}
```

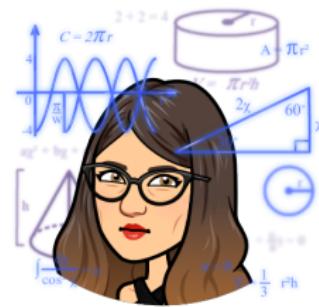
```
\begin{tikzpicture}
\draw[help lines] (-3.5,-1.5) grid (3.5,1.5);
\draw[red, very thick] plot [domain=-pi:pi, samples=100]
(\x,{sinc(5*\x)});
\end{tikzpicture}
```

Exercícios

Exercício III

Defina uma e plote a seguinte função

$$f(x) = \begin{cases} +x, & \text{se } x \text{ par} \\ -x, & \text{se } x \text{ ímpar} \end{cases}$$

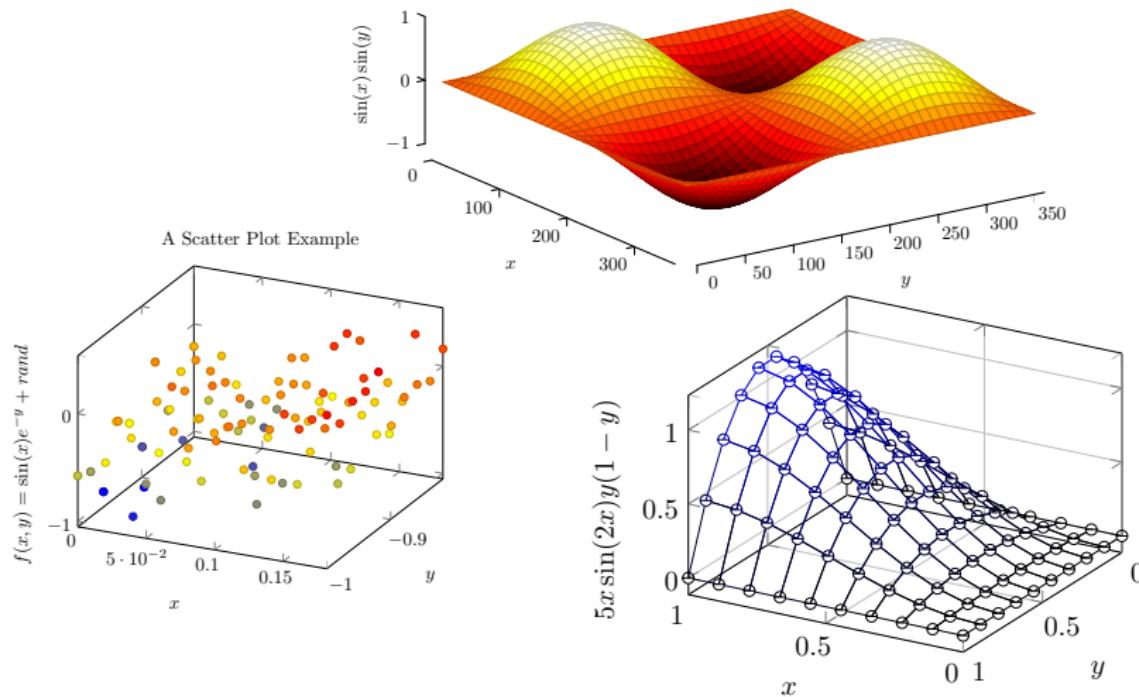


Arroz com feijão

- Plotar funções analíticas em 2D e 3D
- Plotar dados
- Histogramas
- Customizações: cores, legenda

Plots e gráficos

✓ PGFplots oferece recursos para gráficos de excelente qualidade



Gráficos de funções analíticas

```
\documentclass [] {standalone}
\usepackage {pgfplots}

\begin{document}

\begin{tikzpicture}
\begin{axis} [options]

\addplot [domain=\xmin:\xmax,
samples=\npoints, args]
{function};

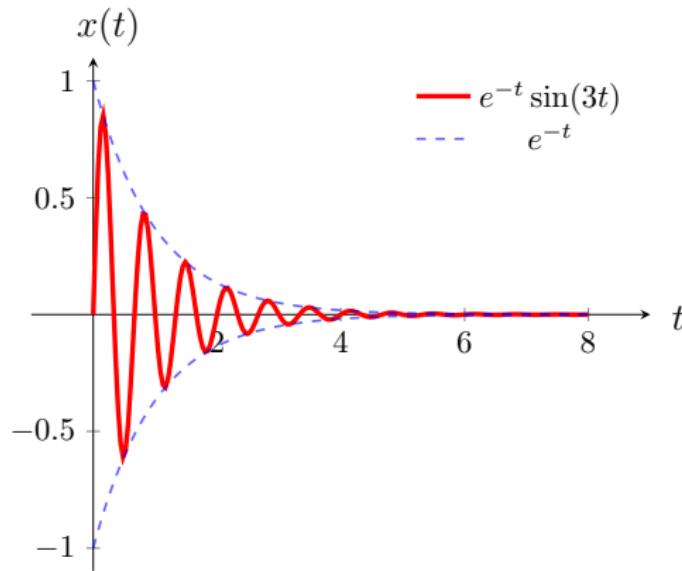
\legend{\$ function\$, };

\end{axis}
\end{tikzpicture}

\end{document}
```

Gráficos de funções analíticas 2-D

\addplot [args] { função };



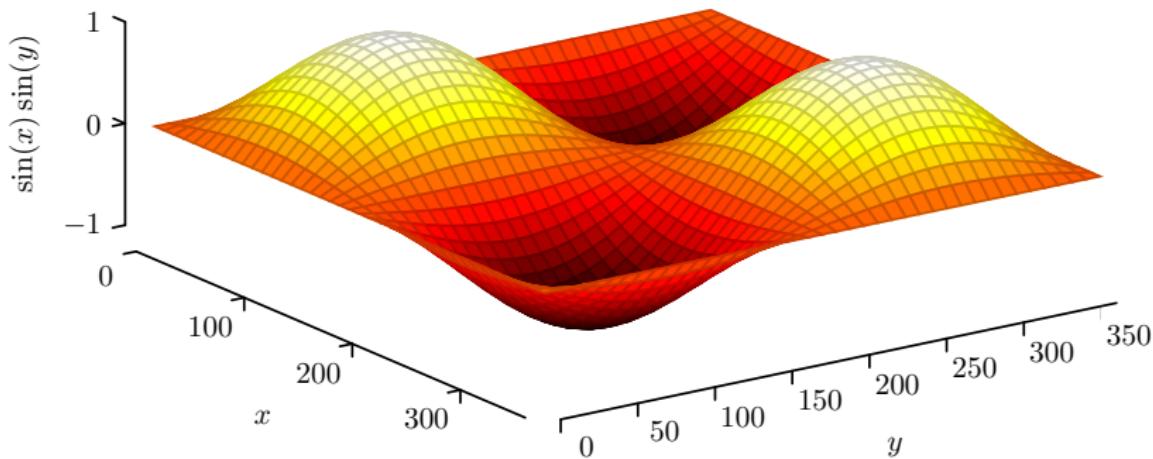
escalas:
axis
semilogaxis
loglogaxis

axis:
xmin, xmax, ymin, ymax
legend style, position
smooth

addplot:
marker
linestyle
domain

Gráficos de funções analíticas 3-D

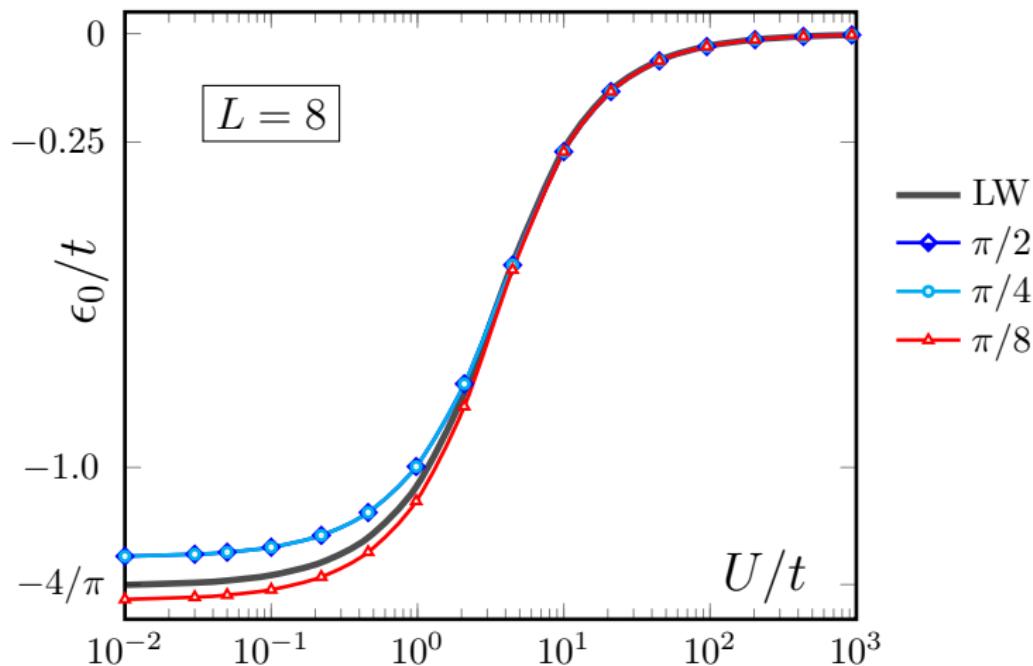
\addplot3[args]{funcao};



Plotando dados de arquivos externos

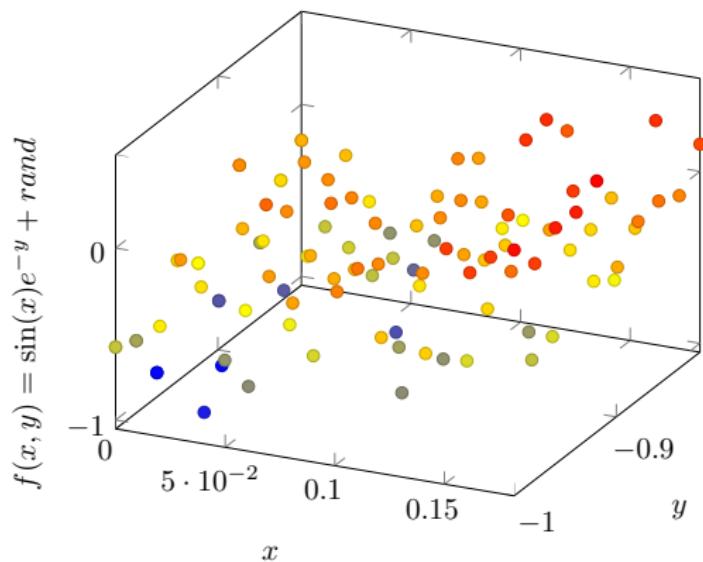
Plotando dados de arquivos externos

```
\addplot [args] table [x index = coluna x, y index= coluna y]
{ arquivo.dat };
```

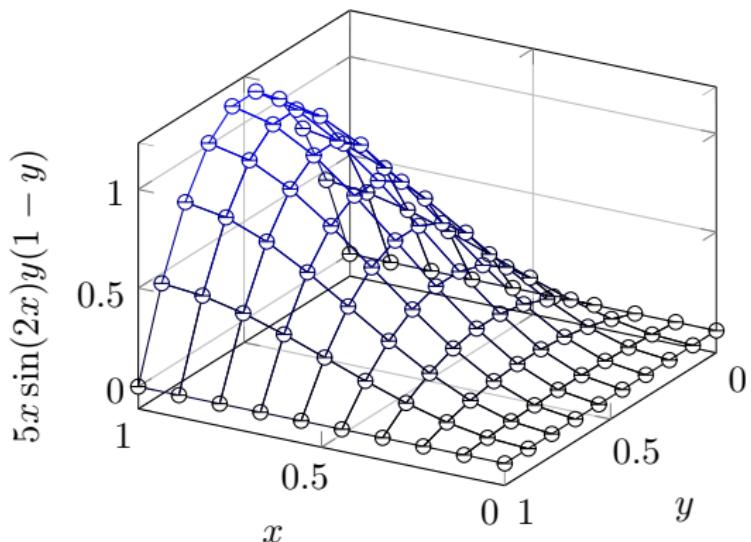


Scatter plots

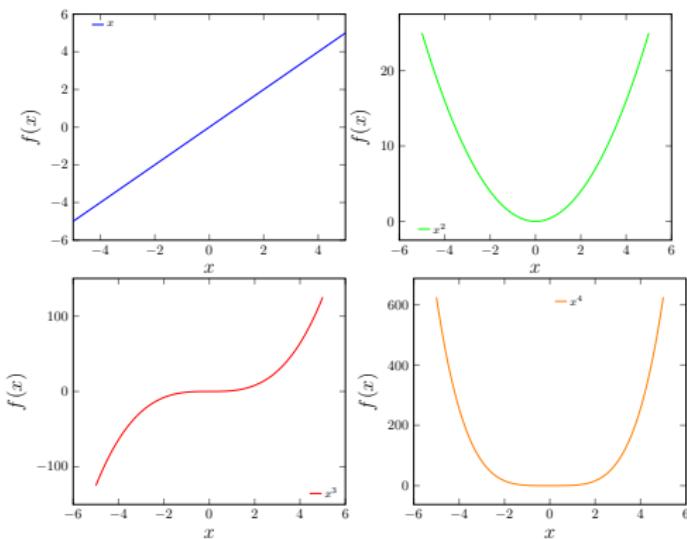
A Scatter Plot Example



Mesh plots

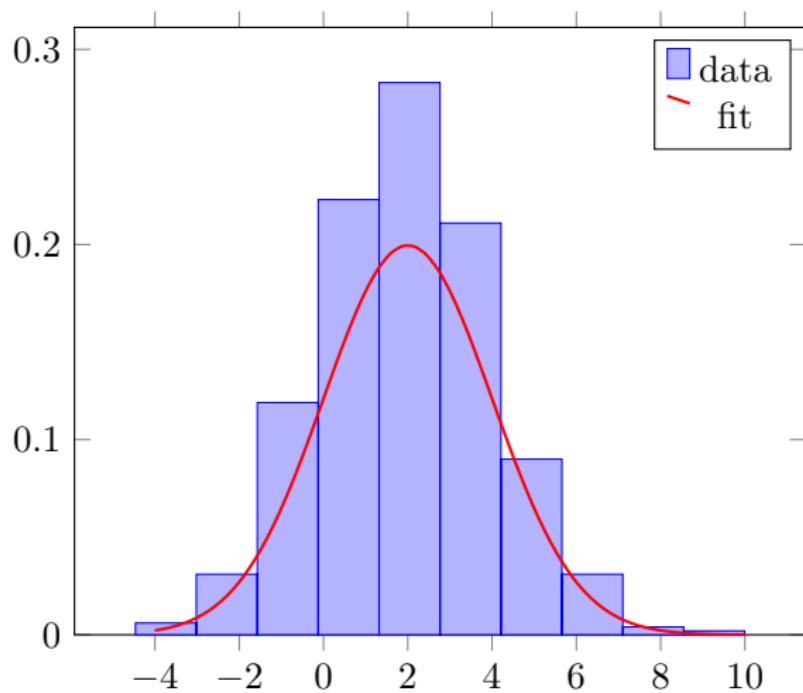


Subplots



```
\begin{axis}[name=subplot-a,...]
\begin{axis}[name=subplot-b, at=(subplot-a.right of north east), anchor=left of north west ...
```

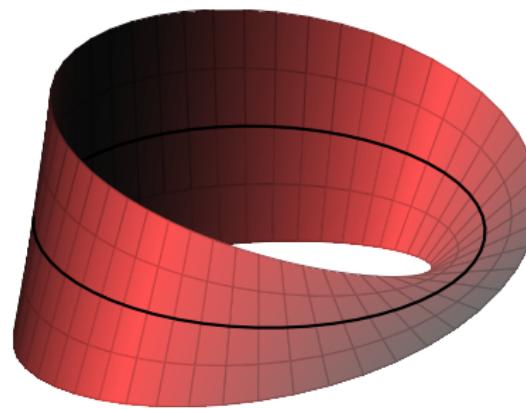
Histogramas



Customizações

✓ costumizações são possíveis 💡 complicadas de implementar ...
Ex: colormap vermelho em uma faixa de moebius

```
\pgfplotsset{ colormap={myred}{rgb255(0cm)=(10,10,10);  
rgb255(1cm)=(255,81,81); rgb255(2cm)=(111,111,111)}}
```

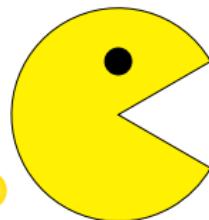


Desenhos aleatoriamente legais

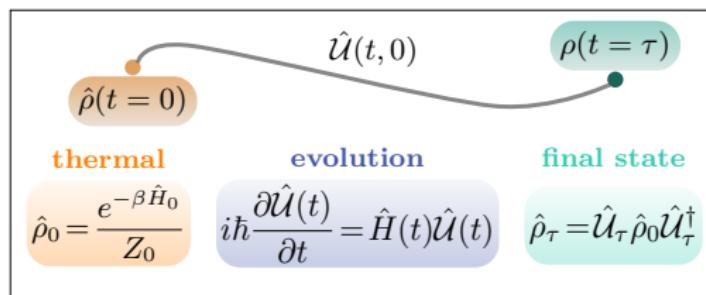
Desenhos aleatoriamente legais

✓ muita coisa legal (e aleatória) pode ser desenhada!

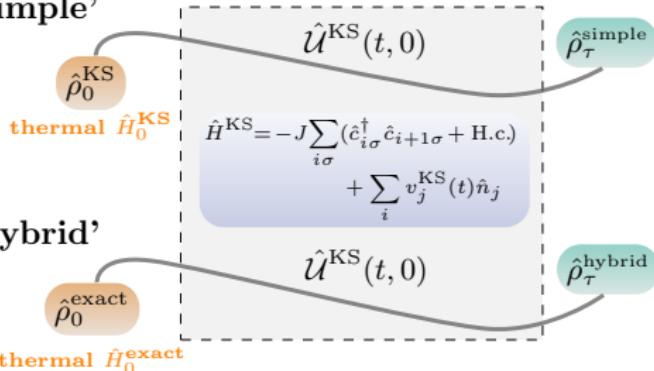
basic	sad	neutral
small smile	big smile	confused
sexy	look up	look down
angry	look left	look right
blush	TeX	Tikz
martian	devilish	almost crying



Alguns diagramas



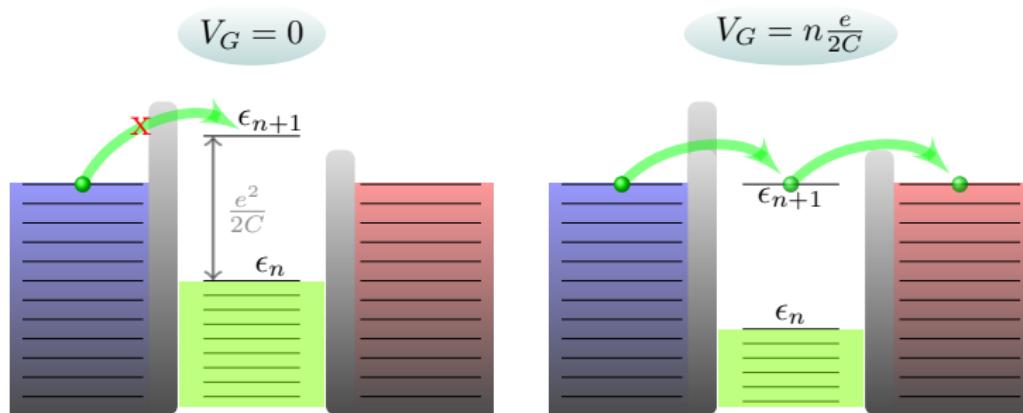
‘simple’



‘hybrid’

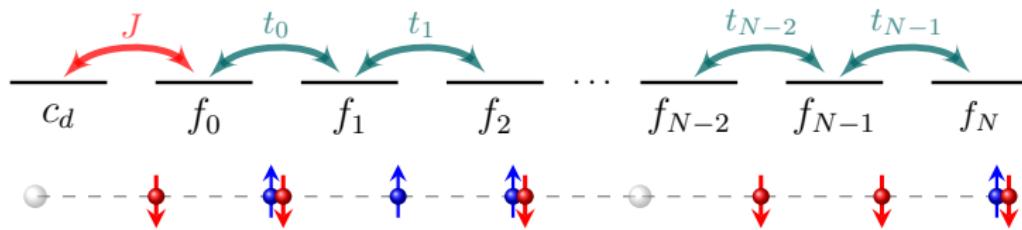
Desenhos aleatoriamente legais

Alguns diagramas



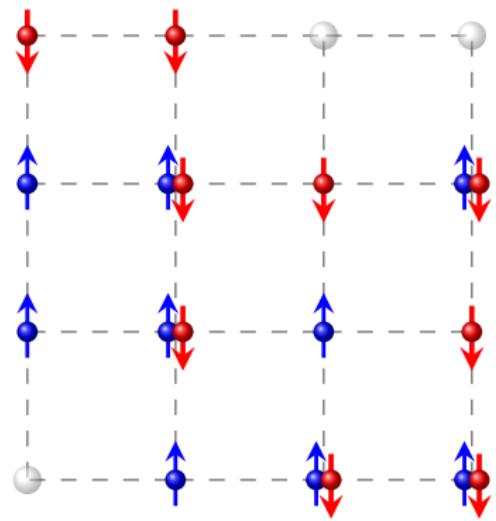
Desenhos aleatoriamente legais

Alguns diagramas



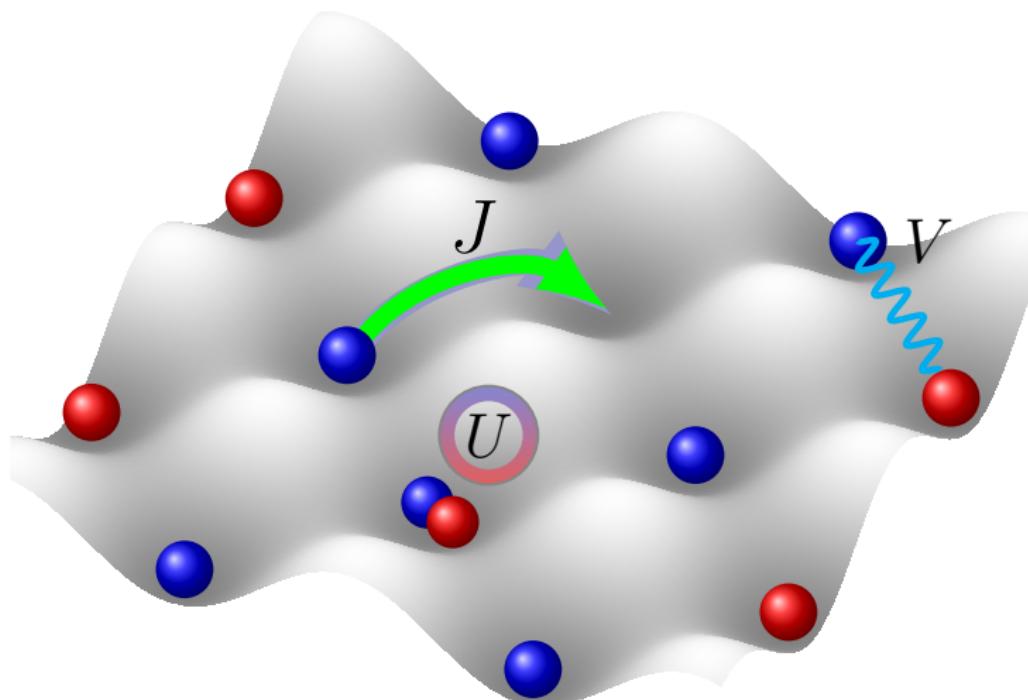
Desenhos aleatoriamente legais

Alguns diagramas



Desenhos aleatoriamente legais

Alguns diagramas



Algumas apresentações

Sistemas eletrônicos fortemente interagentes

Desafios para estudar excitações eletrônicas

4º PIBUS

modelo de Hubbard estendido

$$H = -J \sum_{\langle i,j \rangle} \sum_{\sigma=\uparrow,\downarrow} \underbrace{(c_{i\sigma}^\dagger c_{j\sigma} + c_{j\sigma}^\dagger c_{i\sigma})}_{\text{cinético "hopping"}}, + U \sum_i \underbrace{n_{i\uparrow} n_{i\downarrow}}_{\text{Coulomb local}}, + V \sum_{\langle i,j \rangle} \sum_{\sigma} \underbrace{(n_{i\sigma}^\dagger n_{j\sigma} + n_{j\sigma}^\dagger n_{i\sigma})}_{\text{Coulomb não-local}}$$

1 L

CDW CDW BOW

SS TS

SDW SDW

PS PS

V U

Desenhos aleatoriamente legais

E por fim: a tentativa de auto retrato



Referências

Documentação completa

- <http://www.texample.net/tikz/>
- <http://pgfplots.sourceforge.net/>

Recomendados

- <http://tex.stackexchange.com>
- <http://jgaa.info/getPaper?id=301>
- <http://www.inf.unibz.it/~ebotoeva/fancytikzposter.html>

Agradecimentos

- Mariana
- PET UFU

