

# Conceitos de onda vs. partículas e Pacotes de ondas

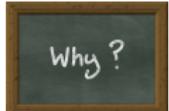
Aula 6

Prof. Márcio Sampaio Gomes Filho



# Observação

- ❖ Esse slides são um complemento à aula ministrada em sala;
- ❖ Explicações/desenvolvimentos serão feitas no quadro.



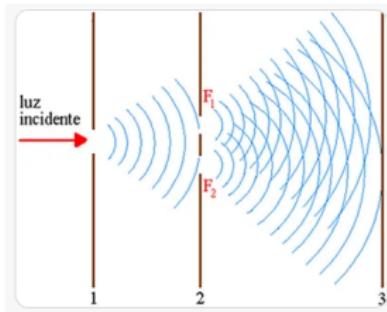
# Informação

- ❖ Página do curso: [https://marciosampaio.github.io/  
fisica-quantica-2025.1.html](https://marciosampaio.github.io/fisica-quantica-2025.1.html)

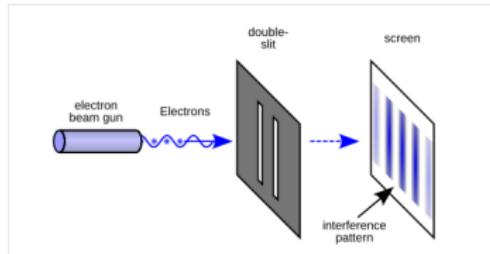
# Sumário

- ❖ Experimento da dupla fenda (comportamento dual de ondas-partículas).
- ❖ Conceitos de onda vs. partículas
- ❖ Pacotes de onda
- ❖ Princípio da incerteza

# Experimento da dupla fenda

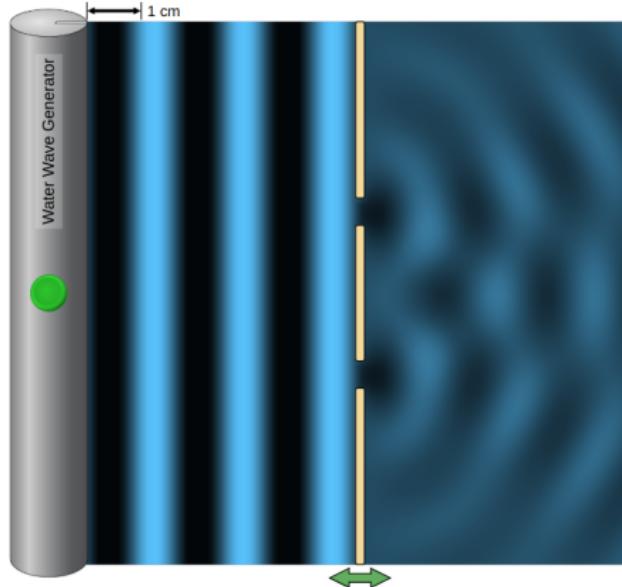


<https://brasilescola.uol.com.br/fisica/experimento-das-duas-fendas.htm>



<https://ideiasesquecidas.com/2018/06/17/o-experimento-da-fenda-dupla/>

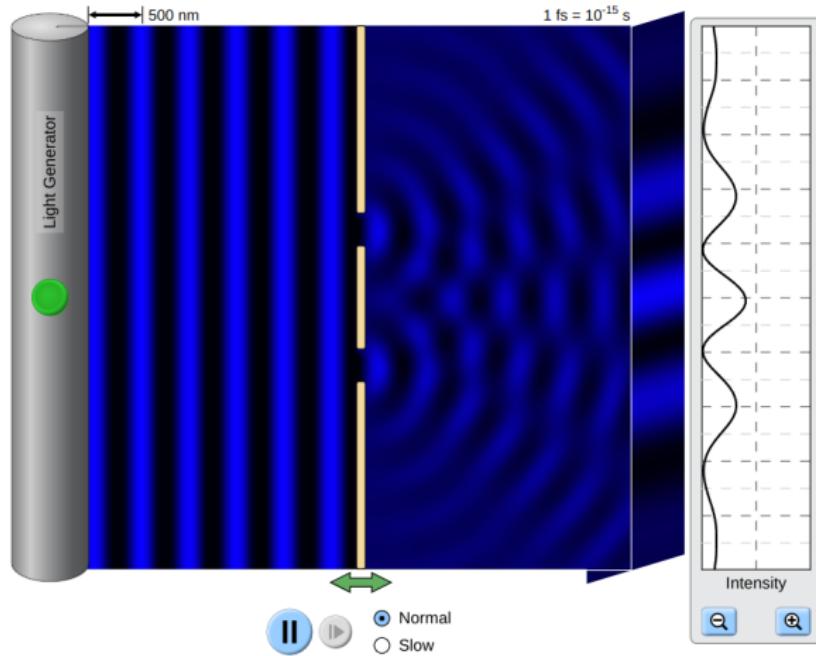
# Faça uma simulação com água



[https:](https://phet.colorado.edu/en/simulations/wave-interference)

//phet.colorado.edu/en/simulations/wave-interference

# Faça uma simulação com a luz



[https:](https://phet.colorado.edu/en/simulations/wave-interference)

//phet.colorado.edu/en/simulations/wave-interference

## Experimento com água



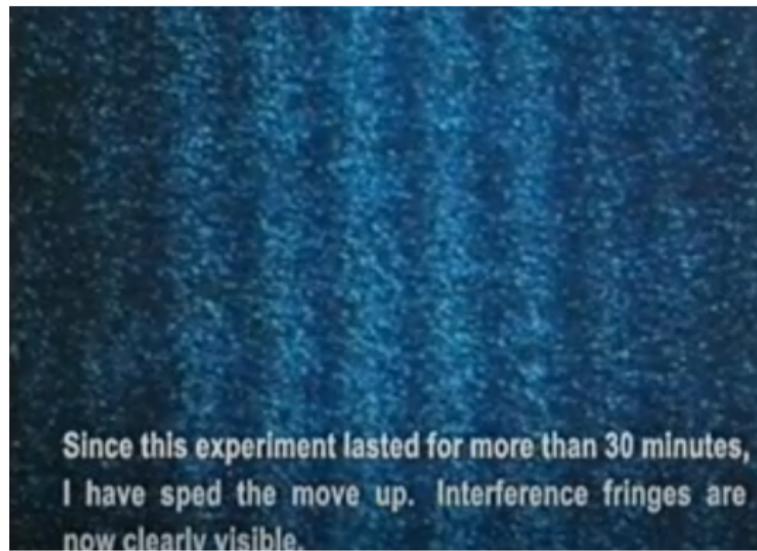
<https://www.youtube.com/watch?v=Iuv6hY6zsdo>

## Experimento com fótons



[https://www.youtube.com/watch?v=\\_MpvDAQrKbs](https://www.youtube.com/watch?v=_MpvDAQrKbs)

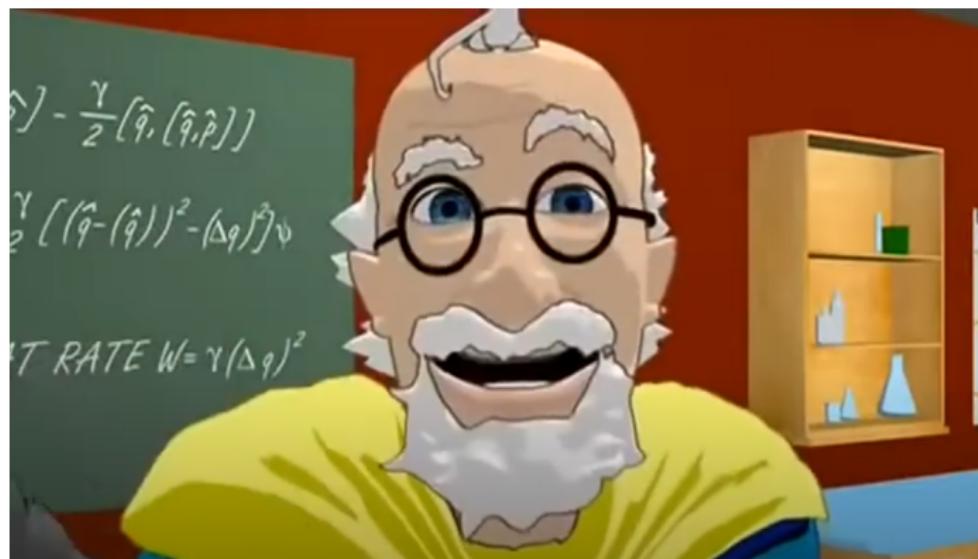
## E com elétrons?



Since this experiment lasted for more than 30 minutes,  
I have sped the move up. Interference fringes are  
now clearly visible.

<https://www.youtube.com/watch?v=ZJ-0PBRuthc>

# Dr Quantum



<https://www.youtube.com/watch?v=NvzSLByrw4Q>

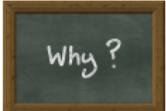
<https://www.youtube.com/watch?v=NvzSLByrw4Q>

# Ondas de matéria

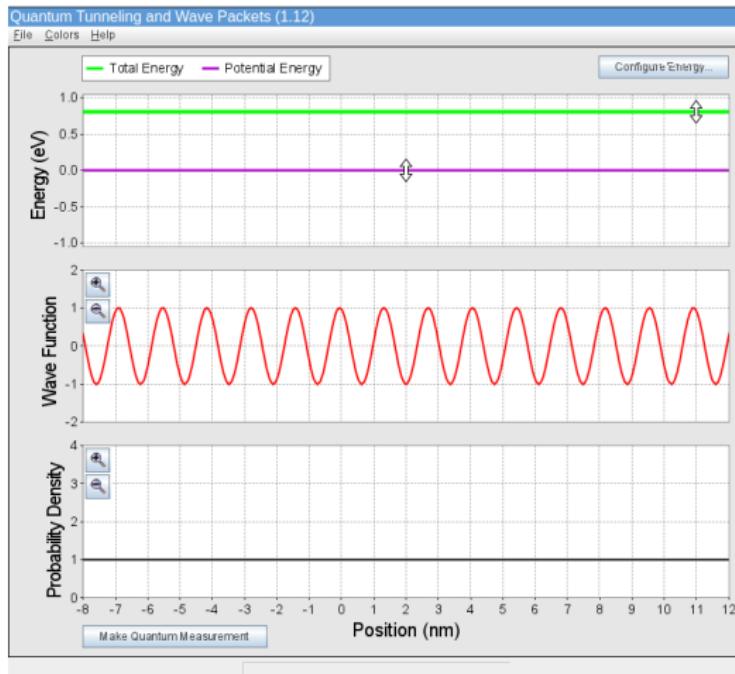
Em qualquer discussão a respeito de ondas, sempre surge a questão: o que está ondulando?

- ❖ No caso de algumas ondas, a resposta é óbvia:
  - nas ondas do mar, é a água que ondula;
  - nas onda sonoras, são as moléculas do ar;
  - no caso da luz, são os campos elétrico e magnético.
- ❖ E no caso das ondas de matéria?
  - no caso das ondas de matéria, o que está ondulando e a **probabilidade de observar a partícula!**

# Ondas vs Partículas

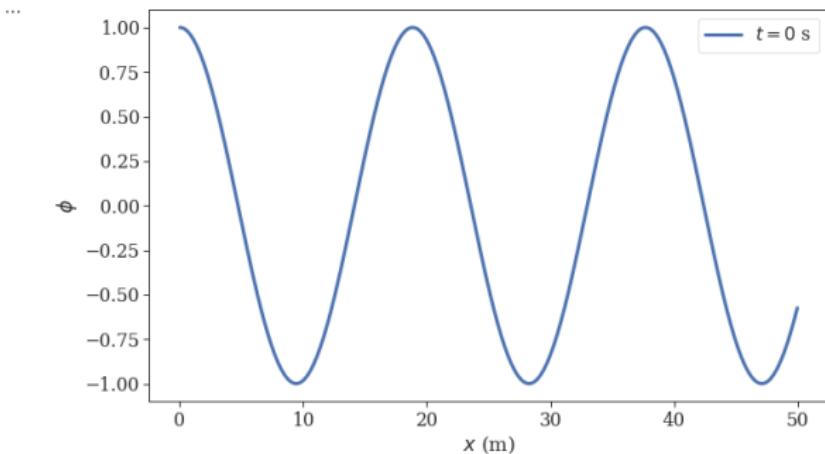


## Exemplo: Onda se propagando (plane wave)



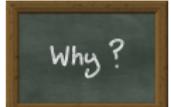
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simulation=quantum-tunneling](https://phet.colorado.edu/sims/cheerpj/quantum-tunneling/latest/quantum-tunneling.html?simulation=quantum-tunneling)

# Exemplo: propagação de ondas

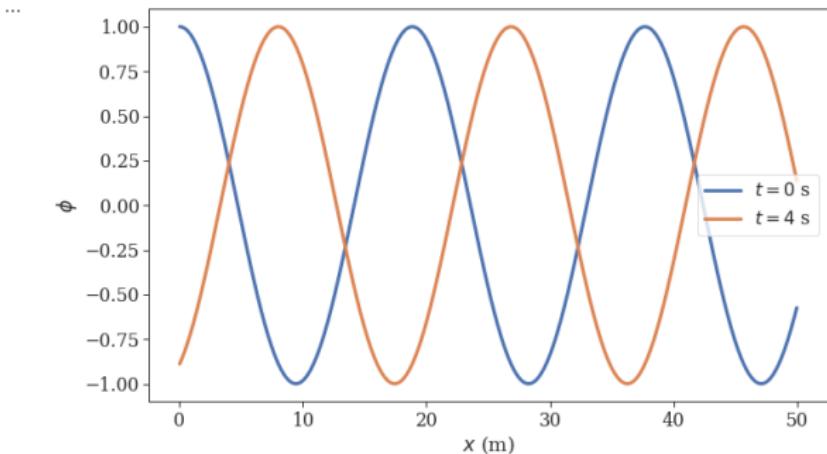


[https://github.com/andlessa/Teaching/blob/master/](https://github.com/andlessa/Teaching/blob/master/FisicaQuantica/ondaPropagacao.ipynb)

FisicaQuantica/ondaPropagacao.ipynb



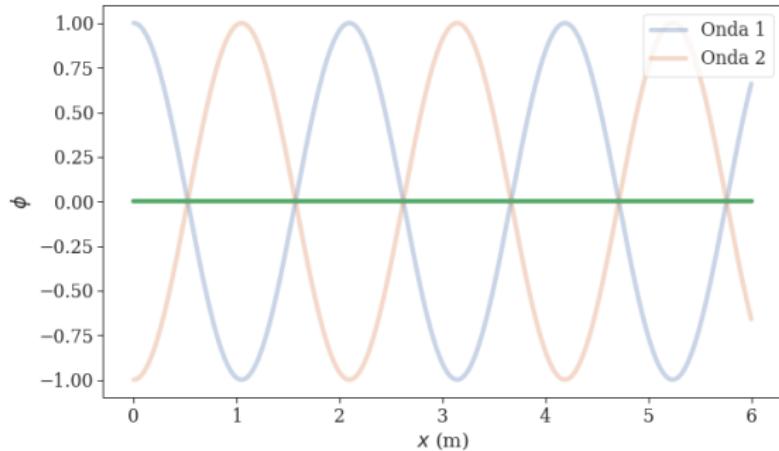
# Exemplo: propagação de ondas



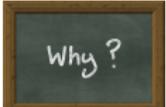
[https://github.com/andlessa/Teaching/blob/master/  
FisicaQuantica/ondaPropagacao.ipynb](https://github.com/andlessa/Teaching/blob/master/FisicaQuantica/ondaPropagacao.ipynb)



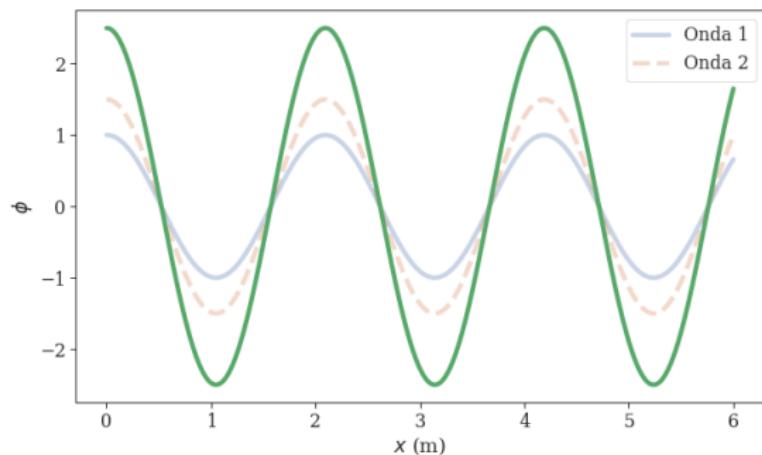
# Exemplo: Interferências de ondas



[https://github.com/andlessa/Teaching/blob/master/  
FisicaQuantica/ondaInterferencia.ipynb](https://github.com/andlessa/Teaching/blob/master/FisicaQuantica/ondaInterferencia.ipynb)



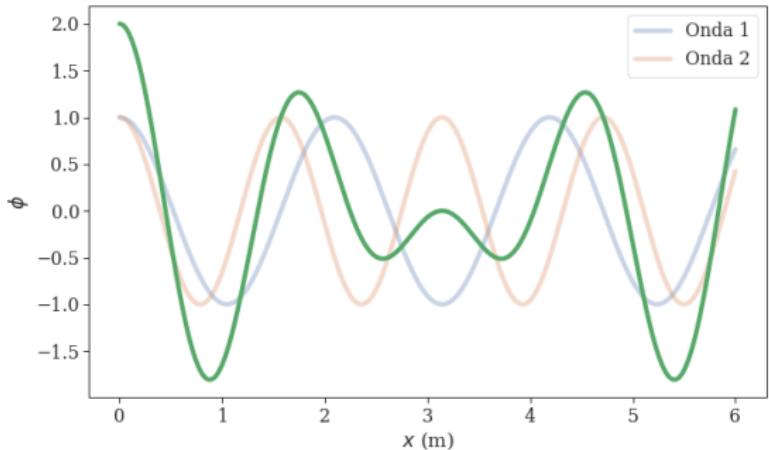
# Exemplo: Interferências de ondas



[https://github.com/andlessa/Teaching/blob/master/  
FisicaQuantica/ondaInterferencia.ipynb](https://github.com/andlessa/Teaching/blob/master/FisicaQuantica/ondaInterferencia.ipynb)



# Exemplo: Interferências de ondas



[https://github.com/andlessa/Teaching/blob/master/  
FisicaQuantica/ondaInterferencia.ipynb](https://github.com/andlessa/Teaching/blob/master/FisicaQuantica/ondaInterferencia.ipynb)

