



Quantum Women  
Invited Talk Series

# From Quantum to Games

A”

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<https://www.aalto.fi/en/school-of-science>

# These slides are meant for sharing references mentioned in the talk

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List of quantum games, more info about quantum games and quantum game jams, QMoss and other quantum art:  
<http://kiedos.art/>

Upcoming quantum game jams and all relevant info:  
<https://itch.io/jam/quantum-game-jam-2023>



**kiedos.art**

Permalink for all the Quantum Women talks:

<http://qisk.it/q-women>

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# 01

## Route to theoretical physics

( Note that you do not need to be a mathematician or a physicist to join quantum workforce or to create quantum games and quantum art! The fields needs a multitude of talents! )

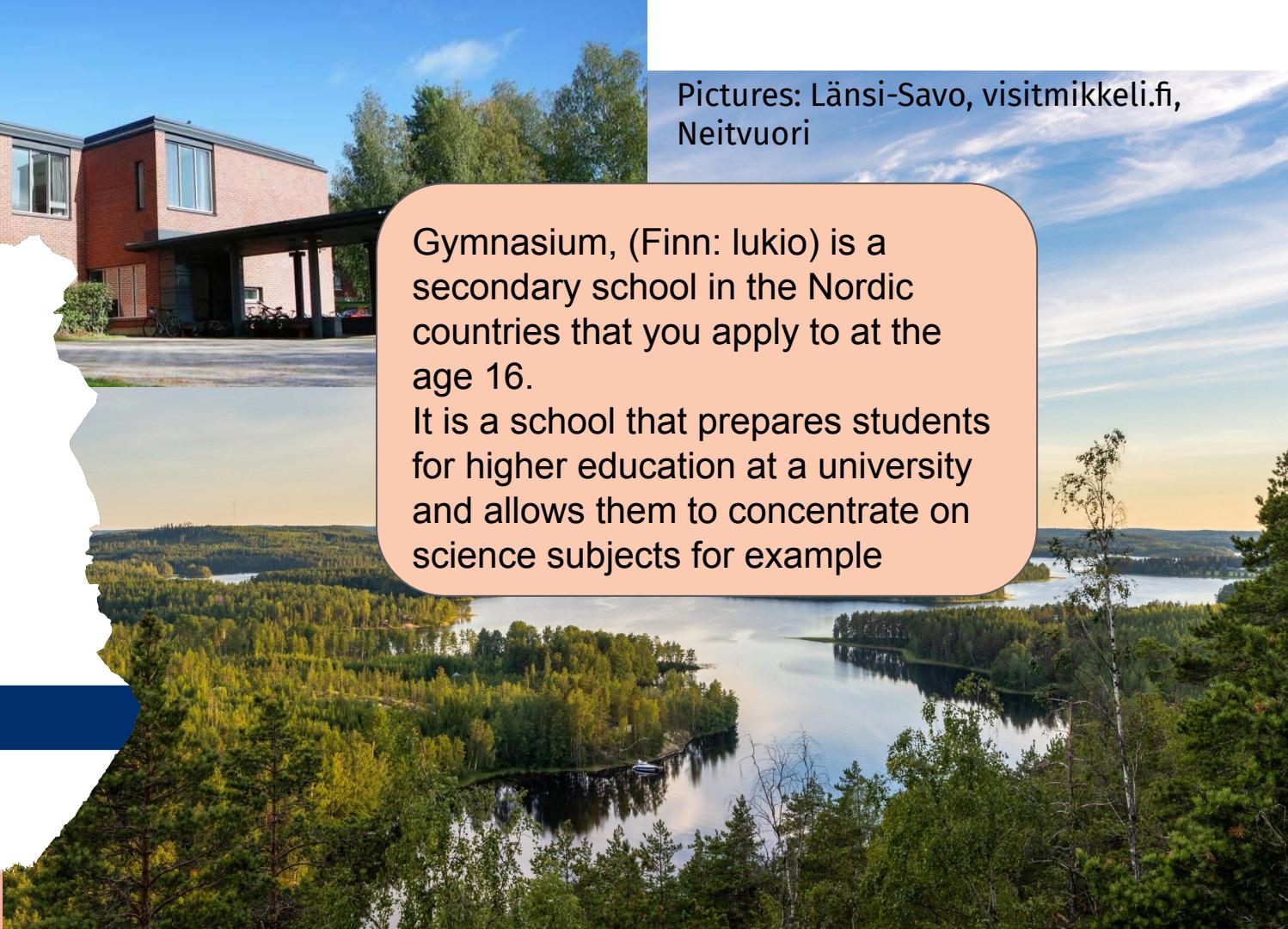


Pictures: Länsi-Savo, visitmikkeli.fi,  
Neitvuori



Gymnasium, (Finn: lukio) is a secondary school in the Nordic countries that you apply to at the age 16.

It is a school that prepares students for higher education at a university and allows them to concentrate on science subjects for example



Finland,  
Northern Europe

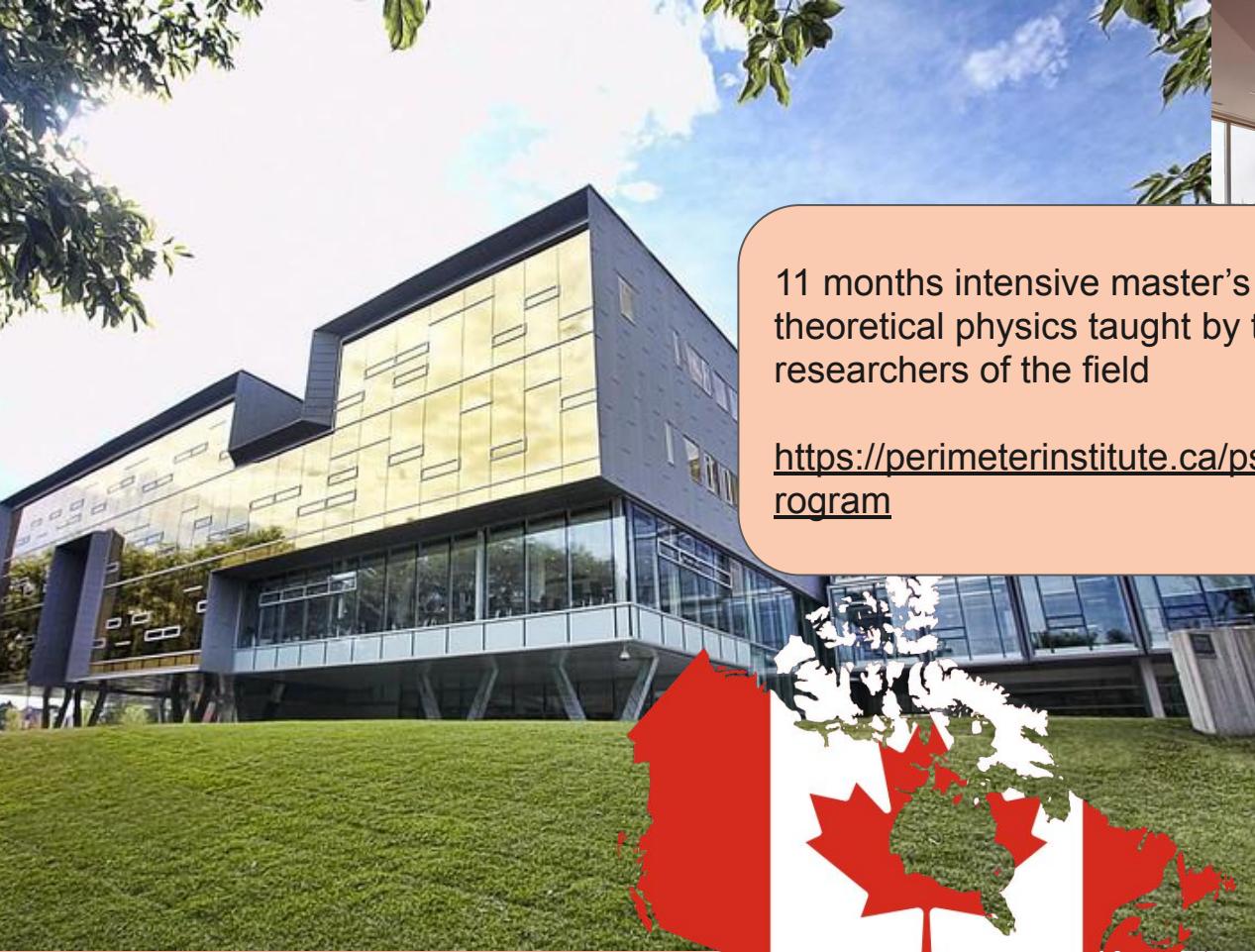
Physics and math students from the student organisation Delta ry in their colourful overalls (Nordic student culture)

Pictures: [utu.fi](http://utu.fi), Delta ry



Studying maths and physics provides you with skills that translate to many professions. I also recommend adding scientific computing courses to your curriculum.

<https://www.utu.fi/en>



11 months intensive master's program in theoretical physics taught by the leading researchers of the field

<https://perimeterinstitute.ca/psi-masters-program>



# Perimeter Scholars International

Waterloo, Ontario

# IQC

Institute for  
**Quantum**  
Computing

Top-research on quantum computing,  
quantum communication, quantum  
sensors and quantum materials  
<https://uwaterloo.ca/institute-for-quantum-computing/>

Picture: University of  
Waterloo



# 02

Theme video "Quantum Rules"  
for the Quantum Game Jam  
2015  
<https://youtu.be/DfJLUH8Kqr8>



## QUANTUM GAME JAM

A platform for quantum game creation

# What are game jams?

Creative game developing events, and bring together game developers, artists, musicians and other experts.

You can find upcoming game jam events related to many types of themes and different types of design constraints at  
<https://itch.io/jams>

# Why game jams?

LEARN NEW SKILLS

MEET NEW PEOPLE

SEE HOW MUCH  
YOU CAN DO!

# Quantum Game Jam

Design constraints are related to quantum physics

<https://www.quantumgamejam.org/>

2014 ‘Déjà-vu’ (quantum), ‘Telepathy’ (quantum), and ‘Vertigo’ (other)

2015 ‘Quantum Rules’ (quantum), ‘Citizen Science’ (meta)

2016 ‘Quantum Mimicry’ (quantum), ‘Quantum Black Box’ (technology), and ‘Superconductivity’ (quantum)

2017 ‘Quantum Blackbox Reborn’ (technology), ‘Riding a Beam of Light’ (quantum), and ‘Watching the Quantum’ (quantum)

2019 ‘Quantum Black Box’ (technology), ‘Q Experience’ (technology), and ‘Noise in the Wheel’ (thematic)

# Quantum Game Jam

A weekend long event,  
games connect to  
quantum physics

A picture from the first-ever Quantum Game Jam (2014) , that was organised locally in a planetarium.





Pictures from the first-ever Quantum Game Jam (2019) with access to quantum computers (IBM)

In the picture is the team behind the game Hamsterwave:  
<https://aarreentertainment.itch.io/hamsterwave>

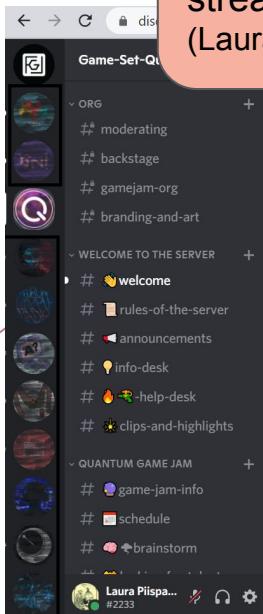


# QUANTUM WHEEL

\* HELSINKI 15.-17.2.2019 \*

IBM Research: The Quantum Wheel 2019 - Game Jam with IBM Q <https://youtu.be/hWH3djDnmQk>

Global Quantum Game Jam 2021:  
Screenshots from our twitch.tv  
stream and our discord server  
(Laura Piispanen and Natasha Skult)



twitch.tv/videos/1164304851

Following Browse Esports Music ⋮ Search Chat on Videos

I → 18 Get Bits 🔍

I →

Global Quantum Game Jam 2021: Screenshots from our twitch.tv stream and our discord server (Laura Piispanen and Natasha Skult)

I could do a screen share of what we currently have (for quantum breakout)

Daria Anttila 10/03/2021 Yes, let us do it! Join the Zoom <https://us02web.zoom.us/j/85900814>

13 days ago Quantum Game Jam 2021 Just Chatting • 189 views

Share ⋮

Jami Kinnunen Jibran Rashid Wen-Sen (Vince) 范森 QIS ONLINE 2 Dawson Fisher Mahnoor Fatima (she...) ONLINE 2 Abu

8:12 itheononis: hello

10:12 ljpis: Join our Quantum Game Jam ! <https://itch.io/jam/online-quantum-game-jam>

4:436 Shalkka: suuper quiet

45:15 sanban9: @Shalkka 🦸‍♂️

Message #chat

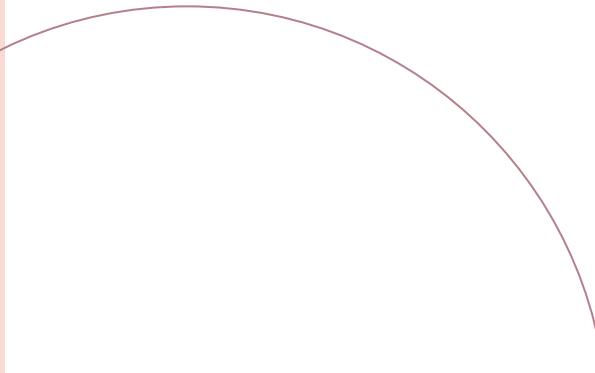
This block contains a screenshot of a Twitch video page for the 'Global Quantum Game Jam 2021'. The video thumbnail shows two women, Laura Piispanen and Natasha Skult, sitting at a desk with a laptop and a large, stylized wooden hexagonal object. The video was posted 13 days ago and has 189 views. The chat section below the video shows several messages from viewers. The top of the page includes navigation links like Following, Browse, Esports, Music, and a search bar. The right side of the page features a sidebar with a 'Chat on Videos' button and other user interface elements.



Screenshots from our final day stream,  
where the games were presented and  
played.  
(Laura Piispanen and Daria Anttila)



03



**Not all quantum  
games have a  
serious purpose**

# Quantum Game:=

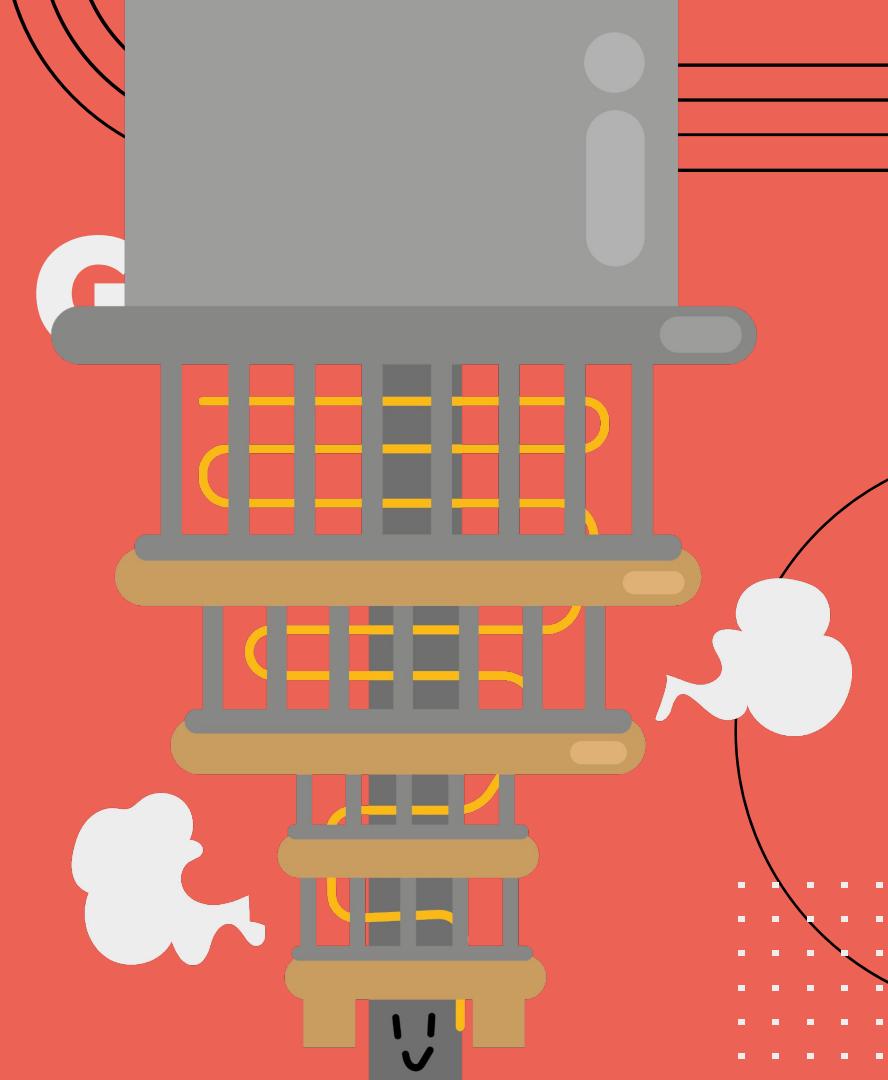
Games that reference the theory of quantum physics,  
quantum technologies or quantum computing through  
**perceivable** means, connect to quantum physics  
through a **scientific purpose** or use  
**quantum technologies.**

# Quantum Game

perceivable means,

Perceivable would refer to anything visual in the game, the story told, effects in the game, or anything otherwise perceivable that would clearly connect to quantum physics.

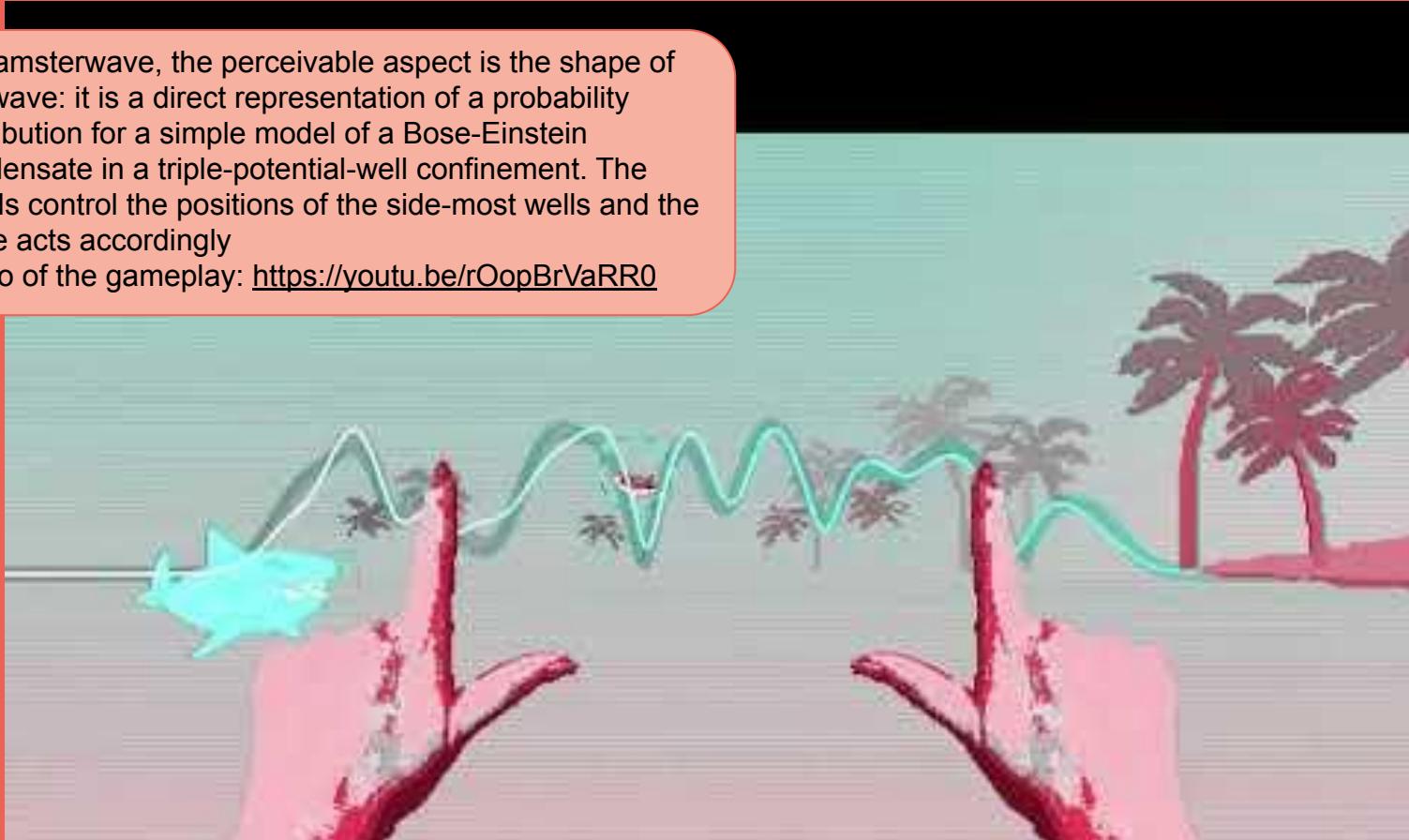
This could be depictions of quantum hardware for example



# Hamsterwave

In Hamsterwave, the perceivable aspect is the shape of the wave: it is a direct representation of a probability distribution for a simple model of a Bose-Einstein condensate in a triple-potential-well confinement. The hands control the positions of the side-most wells and the wave acts accordingly.

Video of the gameplay: <https://youtu.be/rOopBrVaRR0>



# Quantum Games

Games that reference the theories of quantum mechanics or quantum technologies or quantum computing in a **perceivable** means, connecting through a **scientific purpose** or use of **quantum technologies**.

With scientific purposes we mean that the games are meant as educational games or to serve as a citizen science game for example. Citizen science is the act of including anyone interested to participate in data creation, data collection or data manipulation etc.

# Qupcakes



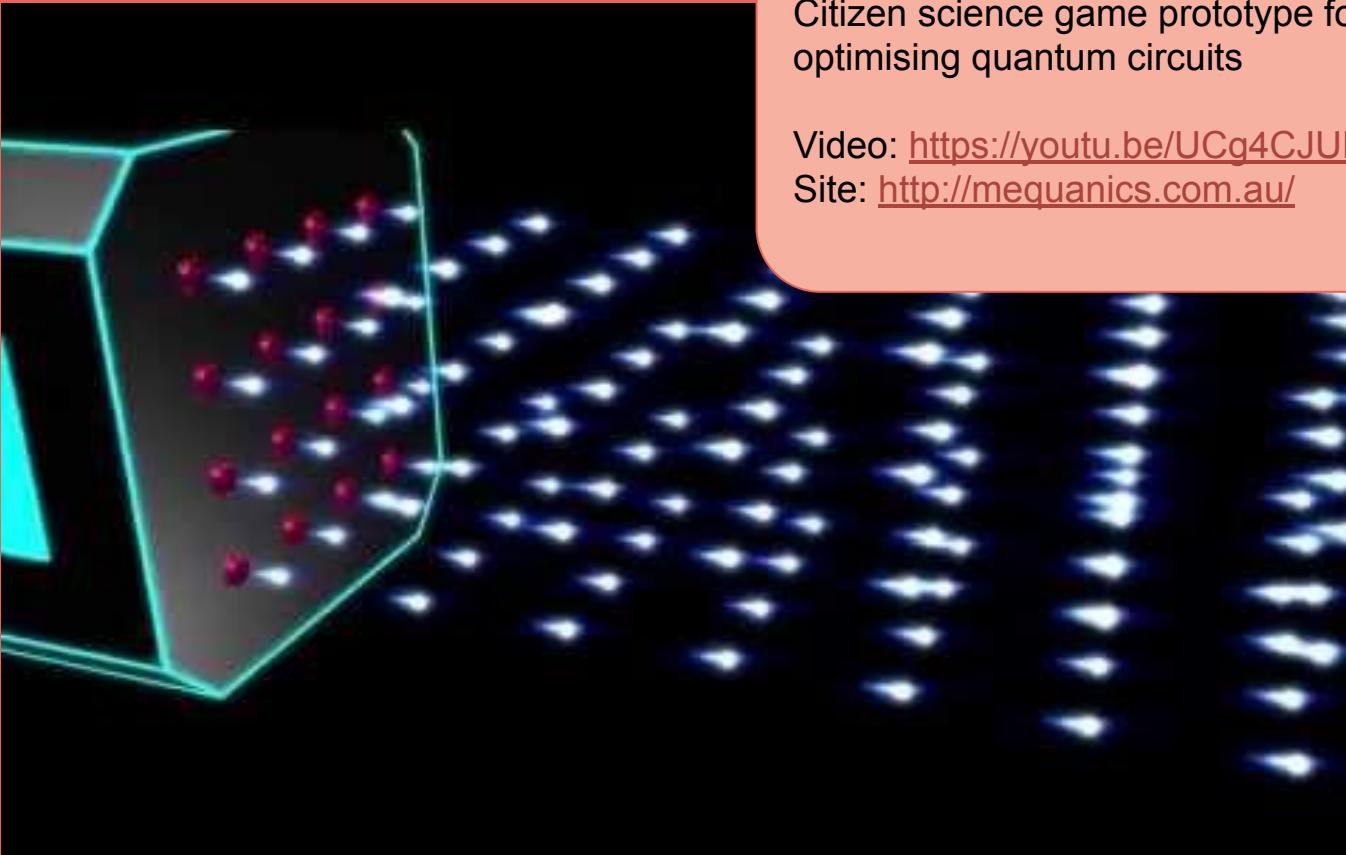
This is an educational game related to quantum computing. It teaches some basic logic behind quantum gates.

Video: [https://youtu.be/ju\\_p3hknUlw](https://youtu.be/ju_p3hknUlw)

Game:

<https://quander.cs.uchicago.edu/>

# meQuanics

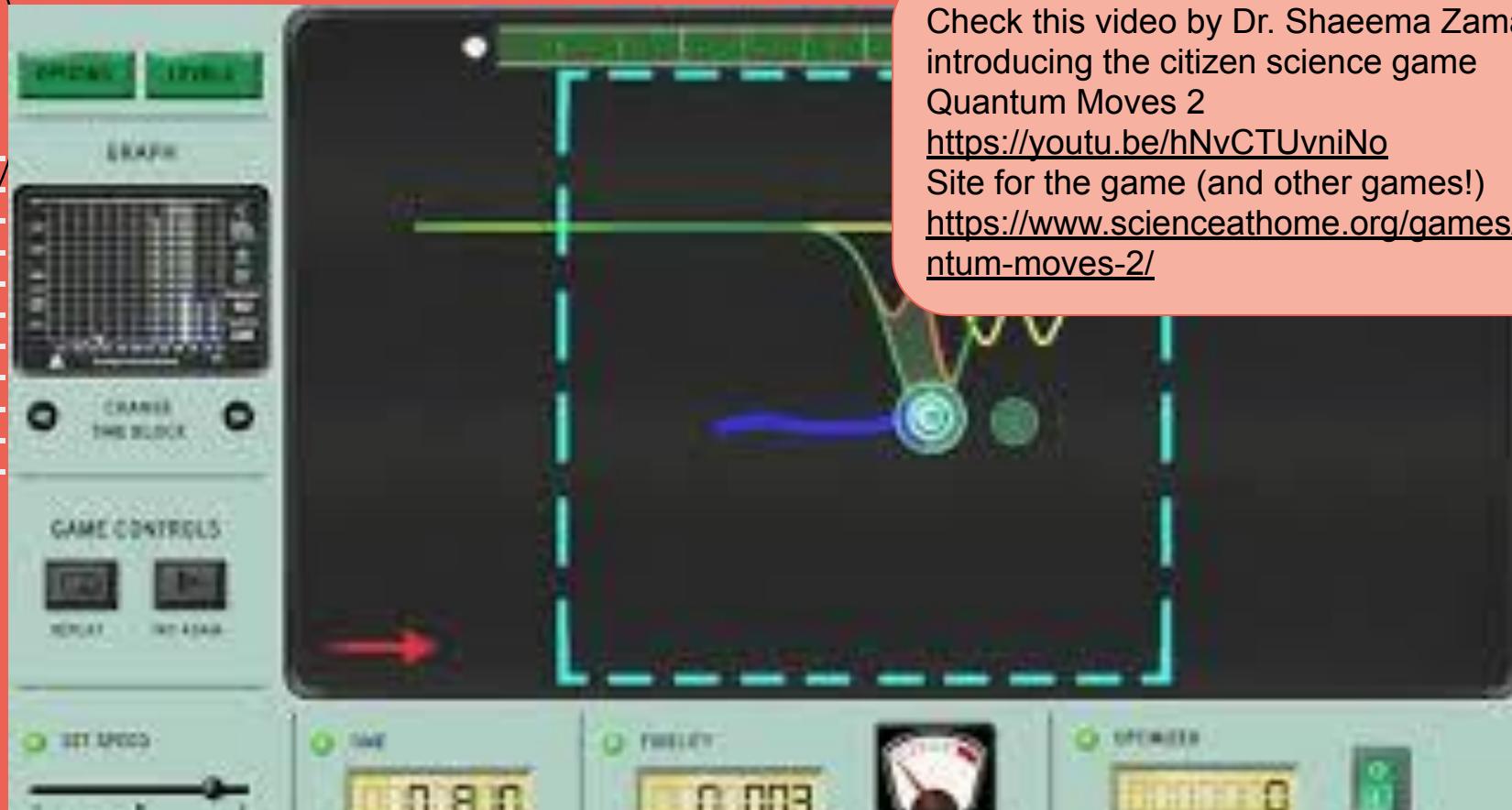


Citizen science game prototype for optimising quantum circuits

Video: <https://youtu.be/UCg4CJUE14c>

Site: <http://mequanics.com.au/>

# Quantum Moves 2



Check this video by Dr. Shaeema Zaman introducing the citizen science game  
Quantum Moves 2

<https://youtu.be/hNvCTUvniNo>

Site for the game (and other games!)

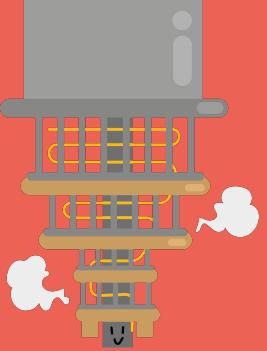
<https://www.scienceathome.org/games/quantum-moves-2/>

# Quantum Game:=

Games that reference the theory  
quantum technologies or quantum  
**perceivable** means, connected  
through a **scientific purpose** or use  
**quantum technologies.**

Some quantum games run on quantum hardware or run a subroutine on quantum hardware. Many more use for example qiskit simulators.

# QCards



Q|Cards> is a card game that not only teaches you quantum computing, but the end layout of cards is scanned and submitted as a quantum circuit to IBM's hardware, which then determines the winner of the round.



# Qubit the Barbarian

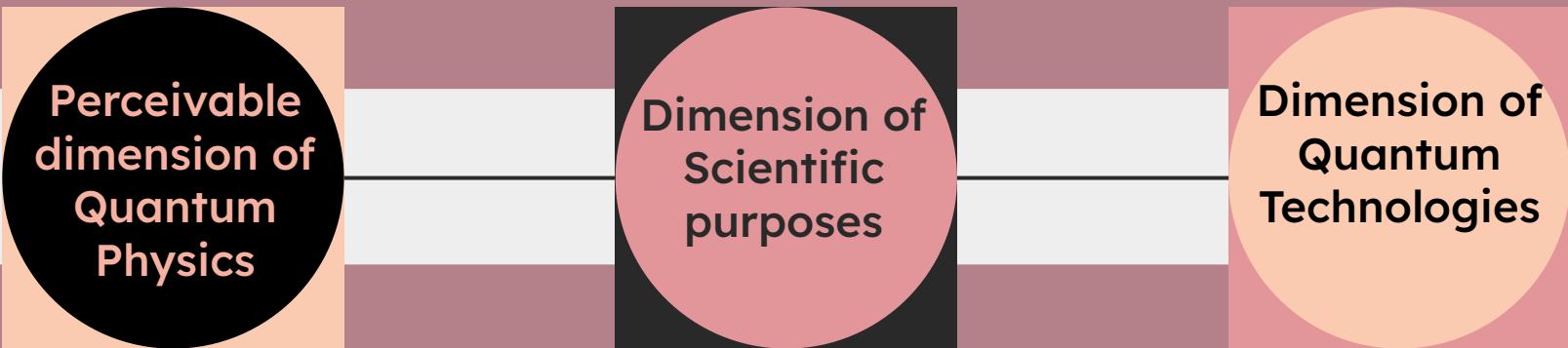


Each tile represents a qubit in the IBM Q-Experience quantum computer prepared in one of the three directions (X, Y, Z) thus having a predetermined or completely random outcome depending on the direction you make your measurement.

Game: <https://exca.itch.io/qubit-the-barbarian>

Video: <https://youtu.be/xfqitL5ZHKO>

A game is a quantum game, if it has qualities that fit to these following aspects we call *the dimensions of quantum games*. A game might connect to quantum physics only through one dimension or have multiple.



# What are the games at the outlines of these dimensions?

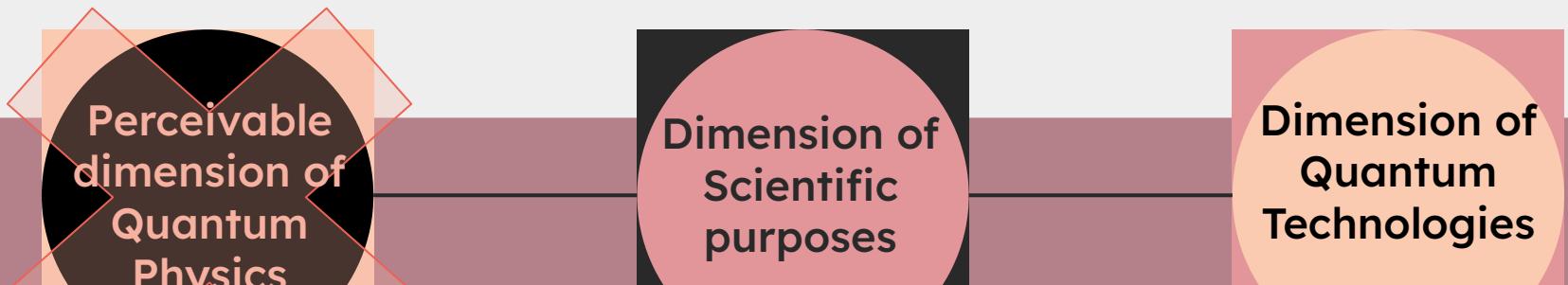
*Quantum Break* references quantum physics through a concept of making “quantum leaps” where the protagonist is able to control time. But this game uses no quantum technologies nor does it have a motivation to be used for educational purposes or for citizen science

Still the core idea of *Quantum Break* and certain visual elements of the game are deeply inspired by quantum physics and have been designed together with a quantum physicist Syksy Räsänen

**Quantum Break,  
Remedy Entertainment  
2016**



# Not all possible kind of quantum games exist



What would a game with no perceivable elements related to quantum physics, that would still have a scientific purpose or use quantum technologies?

04

## Quantum Art

Could we define quantum physics related art in a similar manner, using the same dimensions?



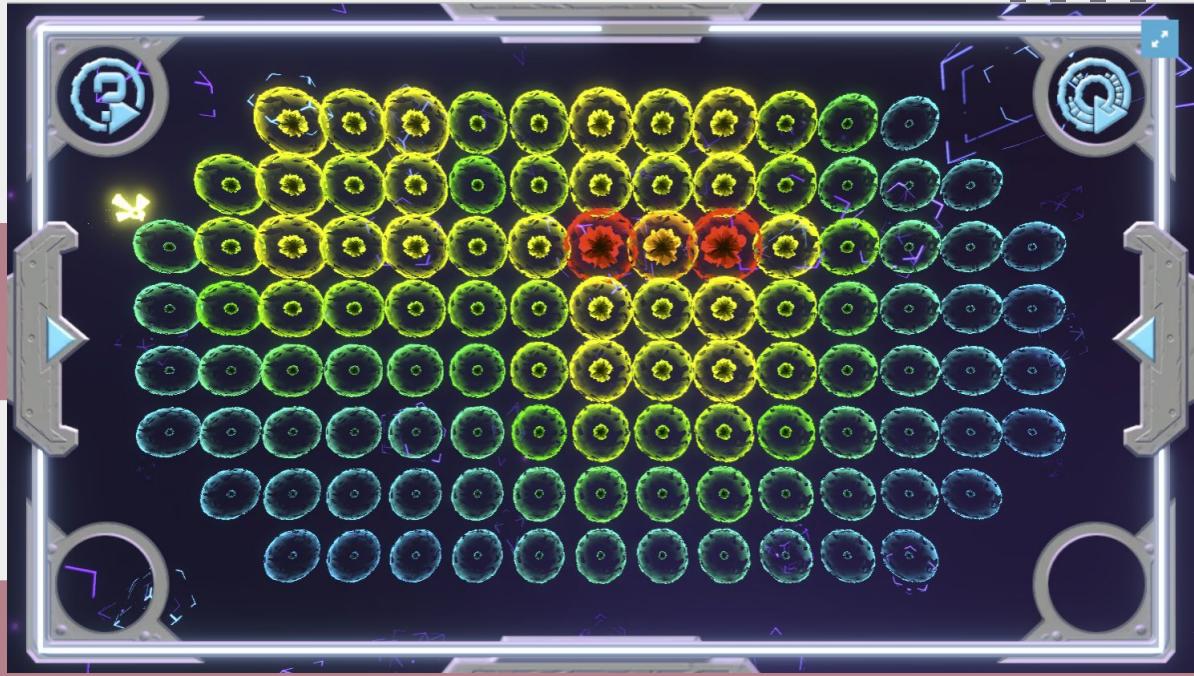
## Quantum Garden, 2018

Runs a numerical simulation of an ideal quantum particle (“quantum random walker”) in a quantum network.

<http://quantum.garden/>



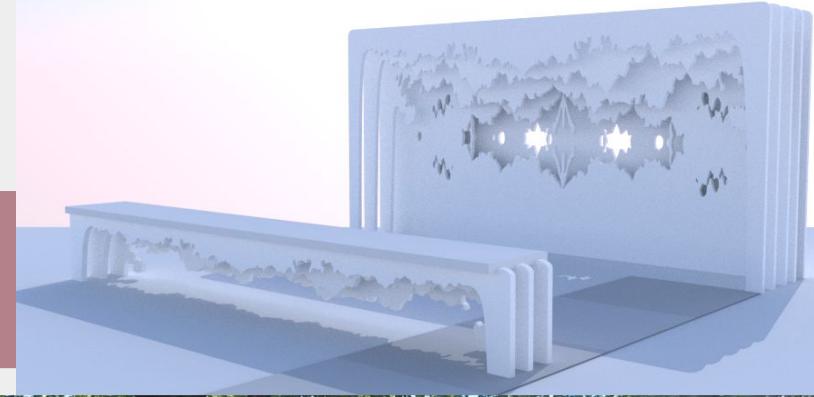
# Quantum Playground, 2020



Also runs a numerical simulation of an ideal quantum particle (“quantum random walker”) in a quantum network. Originally a virtual reality game, but you may play it on a browser at <https://qplaylearn.com/games/quantum-state/quantum-playground/index.html> (check the tutorial! Teaches you a bit about quantum phenomena)

# QMoss, 2022

A physical installation depicting a numerical simulation of a one-dimensional quantum particle confined in a (square)-potential. Horizontal axis is for time, vertical for placement. This heatmap is the probability distribution of the particle. (Also search for quantum carpets)



05



What more could  
there be?

# History of (computer) games

Advantages in new tech, need for showcasing them

Computer became more available

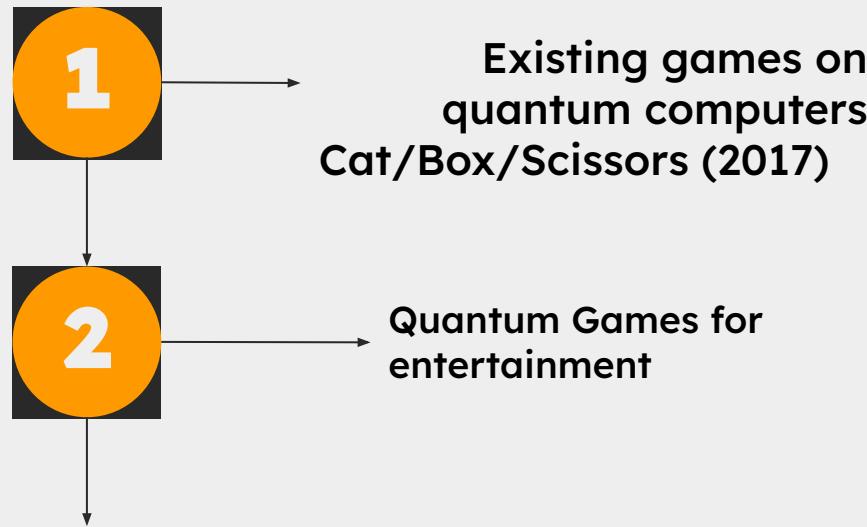
What could computers give to games?



# QUANTUM COMPUTER Games

Quantum Computers, a need for  
showcasing them

Quantum Game Jams  
Games (since 2019)



What could quantum computers give for games?