Quantum Channels

Rules, scoring, and the physics behind the game

Waterloo Quantum Club

1 What is this?

Quantum Channels is a friendly weekly game you play in your browser. Every week, you split 100 "quanta" across 10 channels and try to outscore your opponent. The twist: each week the rules change to mimic a real principle of quantum mechanics, so by playing you build intuition for the strange behaviour of the quantum world.

You do not need any physics background to play. The game teaches you as you go.

2 How a round works

- You have **100 quanta** to spread across **10 channels**.
- Type a value in each channel, or drag the slider, to assign quanta there. The total has to add up to 100.
- You can also place a **Superposition Token** on one channel (more on that below).
- Hit "Submit" to lock in your wavefunction.

When can I play?

- **Submit your wavefunction**: any time, all week, until **Wednesday 9:00 AM**.
- **Resubmit any time**: you can change your mind and update your wavefunction until the 9 AM deadline.
- **Submissions close**: Wednesday 9 AM. Your opponent is revealed.
- **Results posted and new week opens**: Wednesday **7:00 PM**. The next week's rule is revealed, and submissions open again.

3 Scoring

For each of the 10 channels, the player with **more quanta** in that channel wins it. A tie gives no points. Each channel you win is worth **1 point**. Your weekly score is added to your total on the leaderboard.

A perfect week is 10 points. A wipe-out is 0. Most games land in between.

4 The superposition token

Every week you get one Superposition Token. Tap any channel cell to place your token there. The channel you choose matters: at resolution, the token only triggers if you **win** that channel.

- If you **lose** (or tie) the channel: the token does nothing.
- If you **win** the channel: a coin is flipped.

- **Heads (50%)**: the token grants **+3 bonus points**.
- **Tails (50%)**: the token grants **+0 points**.

The token mirrors a real two-state quantum system: until you measure it, the particle is in both winning and losing states at once. Measurement collapses it onto one outcome.

5 Weekly rules

Each week introduces a new quantum rule. Each rule maps to a real concept from quantum mechanics. We will introduce new rules later.

Week 1: Quantum measurement

The rule: when the week resolves, each player's **tallest channel collapses to 0**.

What it teaches: in quantum mechanics, measuring a system disturbs it. Just by looking at where a particle is, you change its state. The boldest bet in your wavefunction is the one that gets measured first, and that measurement wipes it out.

Week 2: Pauli exclusion

The rule: for every channel where *both* you and your opponent placed quanta, **both stacks are wiped to 0**. The channel rejects everyone.

What it teaches: two identical fermions (like electrons) cannot occupy the same quantum state at the same time, which is the Pauli exclusion principle. In the game, if you both try to "occupy" the same channel, neither of you gets it. Predict where your opponent will bet, and bet somewhere else.

Week 3: Quantum tunneling

The rule: after both players submit, every channel rolls a 25% chance to **shift all of its quanta into the next channel to its right** (channel 10 wraps to channel 1). The channel left behind is empty.

What it teaches: quantum tunneling. A particle can sometimes leak through a barrier that classical physics says is impossible. Your carefully-placed quanta might just tunnel away, leaving the original channel empty and stacking into the next one.

Week 4: Heisenberg uncertainty

The rule: after submission, one randomly-chosen channel per player has its value **shifted by a random integer between** -15 **and** $+15$ **quanta** (the channel can't go below 0). Scoring stays the same: 1 point per channel you win.

What it teaches: the uncertainty principle. Some pairs of properties (like position and momentum) can't both be known exactly at the same time. The game adds a dose of uncertainty to one of your channels. You won't know which, or how much, until resolution.

6 Strategy tips

- **Spread, don't pile.** If the tallest-collapse rule is active, piling quanta on one channel guarantees you lose them. Even when it isn't, big stacks tend to be exposed by the weekly twist.

- **You only need +1.** You don't have to crush your opponent in a channel. One extra quantum is enough to win it.
- **Use the token tactically.** Place the token on a channel you're confident you'll win, since the bonus only fires if you win the channel.
- **Read the rule of the week.** Don't play week 3 like week 1. The best distribution depends on what the universe is going to do to your quanta.

7 Frequently asked

Can I see my opponent before the deadline?
No. The opponent is hidden until Wednesday 9 AM, when submissions close.

What if I forget to submit?
You sit out the week, with no opponent and no score added. The physicist-bots only appear when there's an odd number of players who submitted, so the matchmaking can pair everyone up.

Can I change my submission?
Yes. You can resubmit as many times as you want until Wednesday 9 AM. Only the last one counts.

When does the new rule appear?
The new week and its rule open at Wednesday 7 PM, after the previous week's results are posted.

Waterloo Quantum Club, play at uwquantum.com/game.html.
Questions? Find us on Discord.