# If Dirac Teaches Megumin Quantum Mechanics: A Courtroom Play

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## Act 1. In the Warp Courtroom

**Scene:** The courtroom of Slaanesh in the Warp[10]. Megumin[8] is charged with vaporizing three Chaos Marines with her Explosion spell. She is aware of her actions but has not confessed in court.

Paul Dirac[7] appears as her defense attorney. He argues that, by the principle of quantum observation[2], guilt and innocence should be treated as a superposition until a measurement is made.

**Co-defendant:** Aqua[9] is present in the defendant's box due to sheer misfortune, still clueless about the situation.

> **Dirac:**
>
> If the universe follows the laws of quantum mechanics[1, 3], Megumin, your state is not determined until it is observed. That is, your guilt $|G\rangle$ and innocence $|I\rangle$ are in superposition:
>
> $$|\Psi\rangle = \alpha |G\rangle + \beta |I\rangle, \quad \text{with } |\alpha|^2 + |\beta|^2 = 1.$$

## Quantum Interlude I: Quantization of Verdicts

**Dirac (narration):**

The verdict operator of the court is quantized[4] as follows:

$$\hat{H}_{\text{Justice}} |G\rangle = +1 |G\rangle, \quad \hat{H}_{\text{Justice}} |I\rangle = 0 |I\rangle$$

This means verdicts are not emotional gradients, but discrete eigenvalues. One cannot define innocence without defining guilt. That is the quantum identity[1].

## Act 2. The Interference of Guilt

> Dirac:
>
> If the phase is aligned, constructive interference appears:
>
> $$|\Psi\rangle = \frac{1}{\sqrt{2}}(|G\rangle + |I\rangle),$$
>
> and if the phase is opposite,
>
> $$|\Psi\rangle = \frac{1}{\sqrt{2}}(|G\rangle - |I\rangle),$$
>
> then destructive interference reduces the observable probability of guilt[3].

## Interlude II: Uncertainty of Verdict and Sentence

**Dirac (aside):**
If the guilt operator $\hat{G}$ and the sentence operator $\hat{P}$ do not commute[3],

$$[\hat{G}, \hat{P}] \neq 0 \Rightarrow \Delta G \, \Delta P \geq \frac{\hbar}{2}$$

then a precise verdict implies uncertainty in sentencing, and vice versa.

## Act 3. Collapse or Not Collapse

$$\hat{P}_G = |G\rangle \langle G|, \quad \hat{P}_I = |I\rangle \langle I|$$

> **Dirac:**
>
> If you consent to measurement, the wavefunction will collapse[2], and reality will choose a single branch.

> **Megumin:**
>
> ...I accept the observation. Just as I always chose Explosion.

# Act 4. Entanglement and Wigner's Friend

> **Judge Slaanesh:**
>
> Measurement result: $|I\rangle$. Not guilty.

> **Dirac:**
>
> Her guilt component vanished into orthogonality, and Aqua became entangled with the $|G\rangle$ state[4].

**Dirac (internal monologue):**
Even if Megumin knew she was guilty, unless she declares it, no external observation occurs. Hence, the wavefunction remains uncollapsed. This is the puzzle left by Wigner's friend[6].

# Interlude III: State Reconstruction

**Dirac (narration):**
If the court reconstructs the density matrix $\rho$ from testimonies[4],

$$\rho = \sum_{i,j} p_{ij} |i\rangle \langle j|,$$

then this is quantum state tomography. Truth is reconstructed from observation[6].

# Act 5. ...

*(Empty stage. The curtain falls.)*

**Note:** An unobserved world is neither real nor unreal. The verdict in quantum court is always open, and the final question of physics remains: *Who observed it?* [5]

# References

## References

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