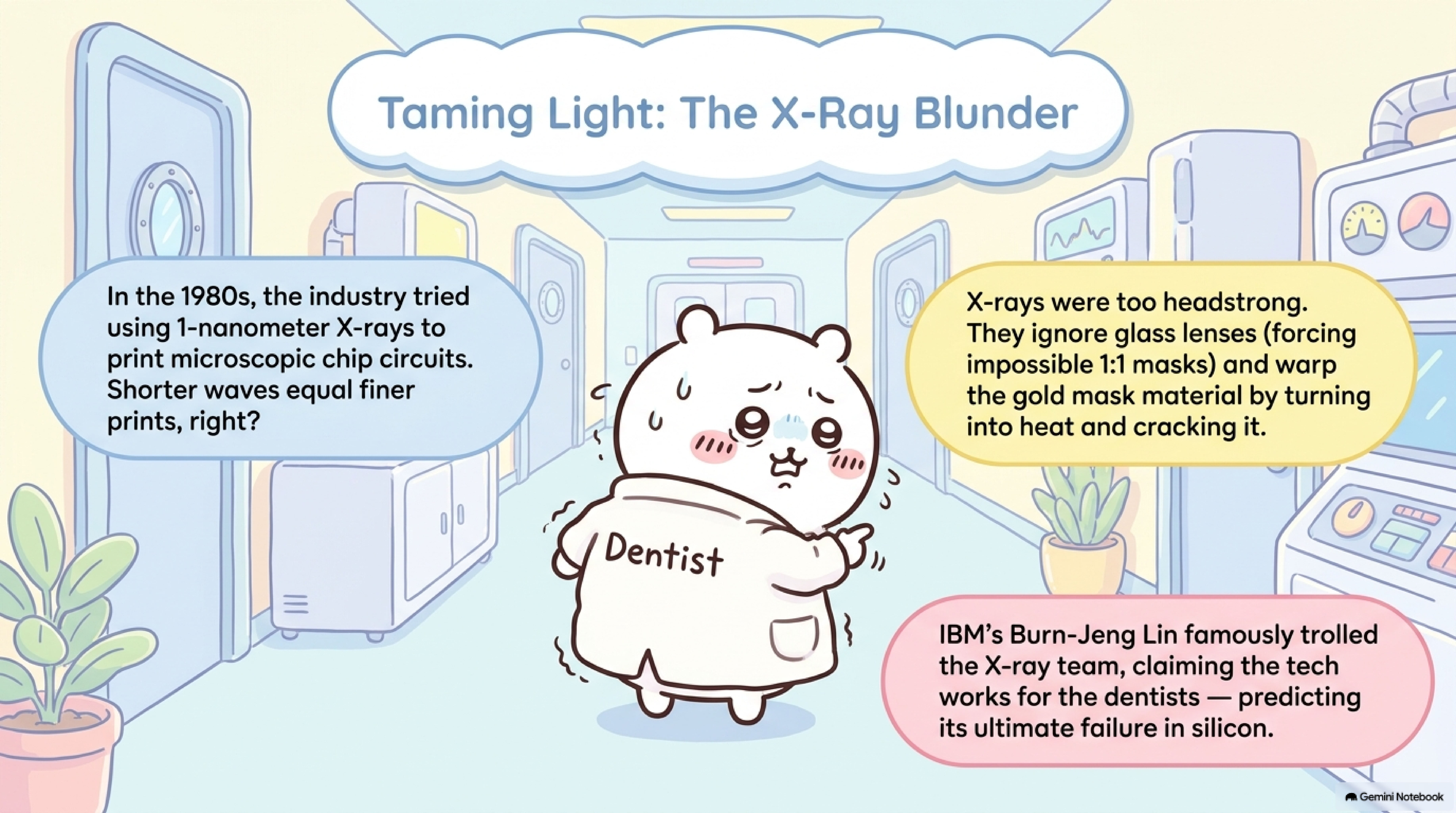
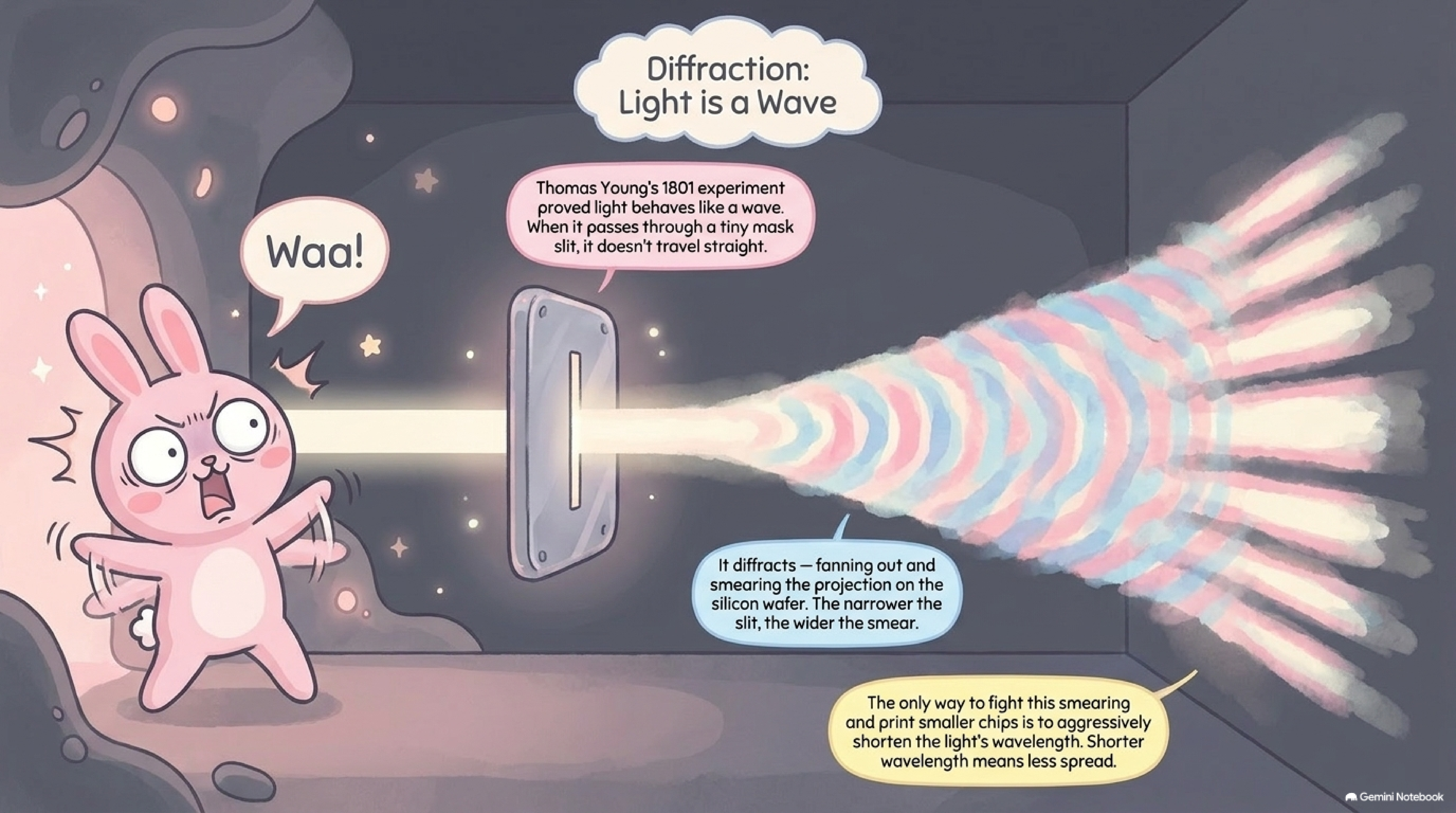
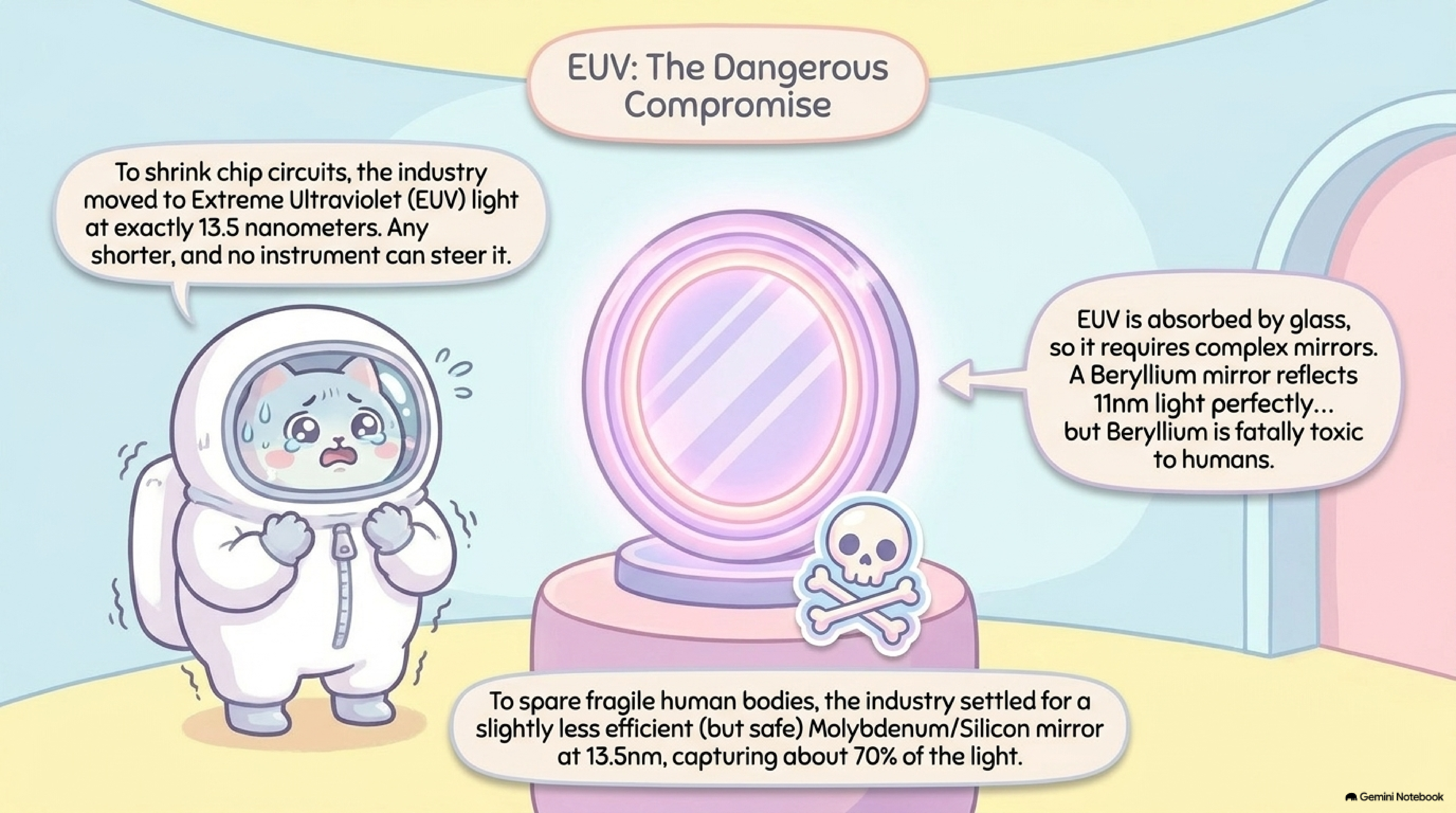


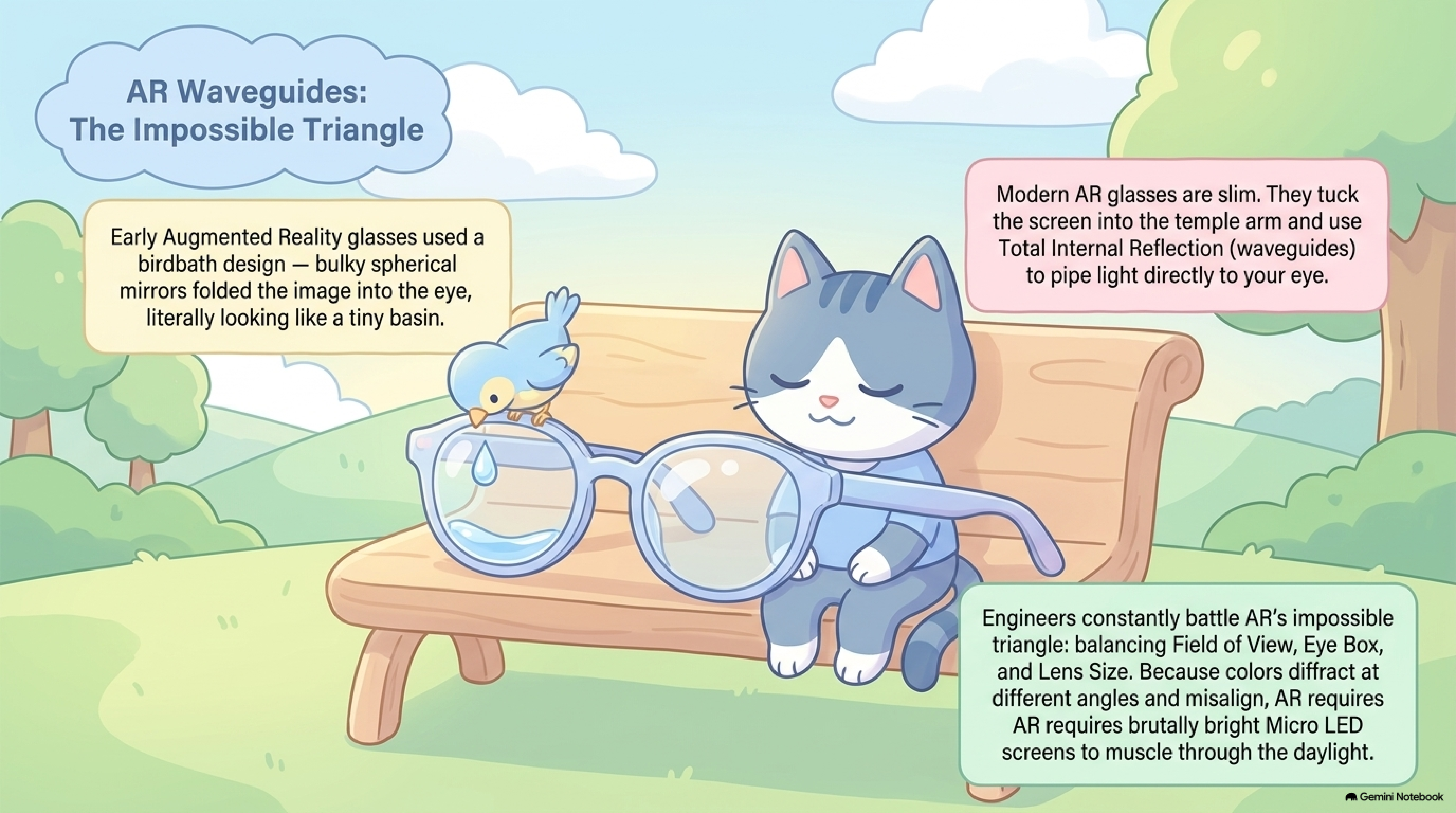
Taming Light: The X-Ray Blunder
In the 1980s, the industry tried using 1-nanometer X-rays to print microscopic chip circuits. Shorter waves equal finer prints, right?
X-rays were too headstrong. They ignore glass lenses (forcing impossible 1:1 masks) and warp the gold mask material by turning into heat and cracking it.
Dentist
IBM's Burn-Jeng Lin famously trolled the X-ray team, claiming the tech works for the dentists — predicting its ultimate failure in silicon.
Gemini Notebook


Quantum Dots: The Glowing Roof
This massive drop releases energy as pure, bright light. Control the crystal size, and you control the color. Smaller dots emit blue, larger ones red. (2023 Nobel Prize in Chemistry).
Shrink the crystal to a few nanometers, and the stairs disappear. Electrons get re-confined and are forced to jump off the roof in one single leap.
Big silicon crystals trap electrons in dense energy stairs. When they fall, they just shuffle down and release heat. Shine light on it, and you get no glow.



Diffraction: Light is a Wave
Waa!
Thomas Young's 1801 experiment proved light behaves like a wave. When it passes through a tiny mask slit, it doesn't travel straight.
It diffracts — fanning out and smearing the projection on the silicon wafer. The narrower the slit, the wider the smear.
The only way to fight this smearing and print smaller chips is to aggressively shorten the light's wavelength. Shorter wavelength means less spread.
Gemini Notebook


EUV: The Dangerous Compromise
To shrink chip circuits, the industry moved to Extreme Ultraviolet (EUV) light at exactly 13.5 nanometers. Any shorter, and no instrument can steer it.
EUV is absorbed by glass, so it requires complex mirrors. A Beryllium mirror reflects 11nm light perfectly... but Beryllium is fatally toxic to humans.
To spare fragile human bodies, the industry settled for a slightly less efficient (but safe) Molybdenum/Silicon mirror at 13.5nm, capturing about 70% of the light.
Gemini Notebook


AR Waveguides:
The Impossible Triangle
Early Augmented Reality glasses used a birdbath design — bulky spherical mirrors folded the image into the eye, literally looking like a tiny basin.
Modern AR glasses are slim. They tuck the screen into the temple arm and use Total Internal Reflection (waveguides) to pipe light directly to your eye.
Engineers constantly battle AR’s impossible triangle: balancing Field of View, Eye Box, and Lens Size. Because colors diffract at different angles and misalign, AR requires AR requires brutally bright Micro LED screens to muscle through the daylight.
Gemini Notebook