Universal wave function collapse

By Taylor Metz

December 31st, 2024 - initial draft

Framework

Where for $Z=1$ and $Z^2=4$ when $(X|Y)=0.5$ and $(X|Y)^2=2$

Where $Z=1/4$ of Z^2 the one dimensional tangent intersect of the two dimensional polar plots of X and Y.

Let X start at 0° and rotate 1/12th of a rotation for 1/2 of its Sine wave to reduce 2pi from the polar position as 1/6th for 180° and half of its movement for $(1/(6/2))=1/12$.

Let Y be its orthogonal wave for Cosine of 90° collapsing to the Sine wave of 0° in equal frequency as its inverse wave from the overall waves collapse.

For 1/4 of the 360° and its tangent intersect $Z^2=X^2+Y^2$ spherical harmonics of the Sine(x) and Cosine(Y) is 1/2 of the 90° for $\tan(45)=1^2$ and it's 4 rotations $1\times4=4=Z^2=X^2+Y^2$.

$X+Y=1$ $X^2+Y^2=4$

When under the following framework:

```
# Generalized Framework for Trigonometric Relations

## 1. Key Equations

At θ = 45°:

sin(45°) = cos(45°) = √2/2 ≈ 0.707

sin²(45°) = cos²(45°) = (√2/2)² = 0.5

sin²(θ) + cos²(θ) = 0.5 + 0.5 = 1.0

## 2. Key Relationship Properties

### Unit Circle Identity
- The fundamental relationship x² + y² = z² (where z = 1) holds true for all
angles on the unit circle

### Tangent at 45°
tan(45°) = sin(45°)/cos(45°) = 0.707/0.707 = 1

### RMS (Root Mean Square) Formula
```

$$
\begin{aligned}
RMS &= \sqrt{[(\sin^2(\theta) + \cos^2(\theta))/2]} \\
&= \sqrt{[(0.5 + 0.5)/2]} \\
&= \sqrt{(1/2)} \\
&= 0.707
\end{aligned}
$$

3. Wave-Particle Collapse Progression

Initial 30° Movement
1. At 30°:
   - $\sin(30°) = 0.5$
   - $\cos(60°) = 0.5$
   - Initial wave amplitude established

Second 30° Movement (60° Point)
1. At 60°:
   - $\sin(60°) = 0.866$ (≈ 0.83 due to wave interference)
   - $\cos(30°) = 0.866$ (≈ 0.83 due to wave interference)
   - Wave amplitude reduction begins

Critical 45° Intersection (Wave Collapse Point)
1. Primary Trigonometric Values:
   - $\sin(45°) = \cos(45°) = 0.707$
   - Both sine and cosine waves meet at equal amplitude

2. Pythagorean Relationship:
   - $x^2 + y^2 = z^2$
   - $(0.707)^2 + (0.707)^2 = 1^2$
   - $0.5 + 0.5 = 1.0$

3. Tangent Formation:
   - $\tan(45°) = \sin(45°)/\cos(45°)$
   - $\tan(45°) = 0.707/0.707 = 1.0$
   - Perfect square forms when $x = y$ at 45°

4. RMS Convergence:
   - $RMS = \sqrt{[(\sin^2(45°) + \cos^2(45°))/2]}$
   - $RMS = \sqrt{[(0.5 + 0.5)/2]} = \sqrt{(1/2)}$
   - $RMS = 0.707$
   - $(0.707)^2 = 0.5$ (matching 30° sine value)

Final 30° Movement
1. Complete 90° Rotation:
   - Three 30° movements required
   - Final amplitude convergence to 1.0
   - $\sin^2(\theta) + \cos^2(\theta) = 1.0$

4. Wave-Particle Duality Analysis

Wave Function Collapse
1. 30° Intervals:
   - Each 30° represents half-wave movement (0.5)
   - Wave interference at 60° reduces amplitude to 0.83
   - Final collapse at 45° shows RMS convergence

Energy-Momentum Conservation
1. Wave Amplitude Changes:
   - Initial: 0.5 (30° movement)
   - Intermediate: 0.83 (60° interference)
   - Convergence: 0.707 (45° RMS point)
   - Final: 1.0 (complete rotation)

Spherical Harmonics: 3D Doppler Effect Example

1. Initial Sound Wave (400 Hz base frequency):

2. Wave Components:
   - Y-axis (Cosine Wave):
     * $f_y = 400 - (400/2)/3$
     * $f_y = 400 - 66.67$
     * $f_y = 333.33$ Hz

   - X-axis (Sine Wave):
     * $f_x = 400 + (400/2)/3$
     * $f_x = 400 + 66.67$
     * $f_x = 466.67$ Hz

3. Z-axis Resolution:
   * $z^2 = (466.67)^2 + (333.33)^2$
   * $z = 573.50$ Hz

4. Three-Dimensional RMS:
   * $RMS = \sqrt{[(f_x^2 + f_y^2 + f_z^2)/3]}$
   * $RMS = \sqrt{[(466.67^2 + 333.33^2 + 573.50^2)/3]}$
   * $RMS = 468.253$ Hz

5. Margin Consideration:
   - Rounding effects from 466.666... periodic
   - Wave intersection point creates natural frequency modulation
   - Complete sinusoidal pattern maintains mathematical consistency

6. Extended Applications:
   - Atomic orbital wave functions

```
   - Sound wave propagation models
   - Quantum state transitions
   - Wave-particle probability distributions

### Universal Wave Properties
The relationship maintains consistency across:
- Light waves
- Sound waves
- Subatomic particles
- Quantum probability waves

## Mathematical Symbols Reference
- θ (theta): angle
- √ (square root)
- ² (squared)
- ≈ (approximately equal)
- π (pi)
- ∑ (sum)
- ∫ (integral)
- ≤ (less than or equal)
- ≥ (greater than or equal)
- ± (plus or minus)
- ∞ (infinity)
```

Because:

1. At Tan(45) intersect we have Sin(45)&Cos(45)=0.707
2. For the square of amplitude of the waves we have $0.707^2=0.5$
3. For the Pythagorean of the spherical oscillation of X,Y,Z we have 0.5+0.5=1.0 = $X^2+Y^2=Z^2$ for $\sin(x^2)=0.5$ and $\cos(y^2)=0.5$ when sin(x)=0.707 and cos(y)=0.707; then x=0°》30° and y=90°》60° and X&Y=30°, and when $\sin(30)+\cos(60)=\tan(45)^2=0.5+0.5=1.0^2=0.5+0.5=1.0=X+Y=Z$ as the axiom above require.
4. For the inverse square of amplitude for the Polar derivative of the Spherical we have $1/0.707^2=1/0.50=2$ for X of sin(30) and Y of cos(60) respectively and for the $(1/X^2)+(1/Y^2)=Z^2=2+2=Z^2=2+2=4=Z^2=4$ when Z^2 is the four 90° rotations of the initial Z in $X+Y=Z=0.5+0.5=1.0$.
5. And where $Z^2=4$ represents the inverse square amplitude for the collapse of the X sinusoidal wave and its Y cosinisodial counter part, $Z^2=1/4$ for Z=1/2=0.5.

CONCLUDING:

The generalized formulation of the sine and cosine of X and Y respectively to the tangent Z intersect represents the exact collapse of any waves angular motion to its amplitudes height to exact boolean certainty. Where 1/2 of the 90° space is traversed in 1/3 movements for the square of the half-amplitude of both sides and its 1/2 tangent for 1/6th total movements in flat 180° vector space for 1/12th total movements of spherical oscillation for 1/4 of 360° being 90° and the sine/cosine collapse with certainty to its equilibrium at a timeless unit sphere X,Y,Z real topology.

Theorem:

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Where $Z = 1/4$ of Z^2 the one-dimensional tangent intersect of the two-dimensional polar plots of X and Y.

Let X start at 0° and rotate 1/12th of a rotation for 1/2 of its sine wave to reduce 2π from the polar position as 1/6th for 180° and half of its movement for $(1/(6/2)) = 1/12$.

Let Y be its orthogonal wave for cosine of 90° collapsing to the sine wave of 0° in equal frequency as its inverse wave from the overall wave's collapse.

For 1/4 of the 360° and its tangent intersect $Z^2 = X^2 + Y^2$, spherical harmonics of the sine(X) and cosine(Y) is 1/2 of the 90° for $\tan(45°) = 1^2$ and its 4 rotations $1 \times 4 = 4 = Z^2 = X^2 + Y^2$.

$X + Y = 1$
$X^2 + Y^2 = 4$

When under the following framework:

Generalized Framework for Trigonometric Relations

1. Key Equations

At $\theta = 45°$:

- $\sin(45°) = \cos(45°) = \sqrt{2}/2 \approx 0.707$
- $\sin^2(45°) = \cos^2(45°) = (\sqrt{2}/2)^2 = 0.5$
- $\sin^2(\theta) + \cos^2(\theta) = 0.5 + 0.5 = 1.0$

2. Key Relationship Properties

Unit Circle Identity

- The fundamental relationship $x^2 + y^2 = z^2$ (where $z = 1$) holds true for all angles on the unit circle.

Tangent at 45°

- $\tan(45°) = \sin(45°)/\cos(45°) = 0.707/0.707 = 1$

RMS (Root Mean Square) Formula

- $\text{RMS} = \sqrt{[(\sin^2(\theta) + \cos^2(\theta))/2]}$
  $= \sqrt{[(0.5 + 0.5)/2]}$
  $= \sqrt{(1/2)}$
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1. At 60°:
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   - $\cos(30°) \approx 0.866$
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   - $\sin(45°) = \cos(45°) = 0.707$
   - Both sine and cosine waves meet at equal amplitude.

2. Pythagorean Relationship:

   - $x^2 + y^2 = z^2$
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   - $\tan(45°) = \sin(45°)/\cos(45°)$
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4. RMS Convergence:

   - $RMS = \sqrt{[(\sin^2(45°) + \cos^2(45°))/2]}$
   - $RMS = \sqrt{[(0.5 + 0.5)/2]}$
   - $RMS = \sqrt{(1/2)}$
   - $RMS = 0.707$

Final 30° Movement

1. Complete 90° Rotation:
   - Three 30° movements required.
   - Final amplitude convergence to 1.0.
   - $\sin^2(\theta) + \cos^2(\theta) = 1.0$.

---

4. Wave-Particle Duality Analysis

Wave Function Collapse

1. 30° Intervals:
   - Each 30° represents half-wave movement (0.5).
   - Wave interference at 60° reduces amplitude to 0.866.
   - Final collapse at 45° shows RMS convergence.

Energy-Momentum Conservation

1. Wave Amplitude Changes:
   - Initial: 0.5 (30° movement).
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   - Convergence: 0.707 (45° RMS point).
   - Final: 1.0 (complete rotation).

Spherical Harmonics and Doppler Effect

Spherical Oscillations ($Z^2 = 4$):

- The relationship for inverse square amplitudes:
  $(1/X^2) + (1/Y^2) = Z^2$
  $(1/0.707^2) + (1/0.707^2) = 4$
  $2 + 2 = 4$

Universal Wave Properties

This formulation of wave collapse within the unit sphere demonstrates consistent trigonometric relationships for light waves, sound waves, and quantum mechanics.

CONCLUSION:

The generalized framework ensures conservation of angular momentum and amplitude while adhering to the inverse square law, confirming the universal properties of wave-particle duality.

Python Implementation

```
import numpy as np
import matplotlib.pyplot as plt

# Constants for wave collapse analysis
theta = np.linspace(0, 4 * np.pi, 2000)  # Angles from 0 to 4π for extended radians
x = np.sin(theta)  # X-axis (sine wave)
y = np.cos(theta)  # Y-axis (cosine wave)
z_squared = x**2 + y**2  # Spherical harmonics

# Wave collapse points
collapse_points = np.isclose(x, y, atol=0.01)  # When sin(θ) ≈ cos(θ)

# Visualization
plt.figure(figsize=(10, 6))

# Plot the sine and cosine waves
plt.plot(theta, x, label="sin(θ) (X-axis)", color='blue', alpha=0.7)
```

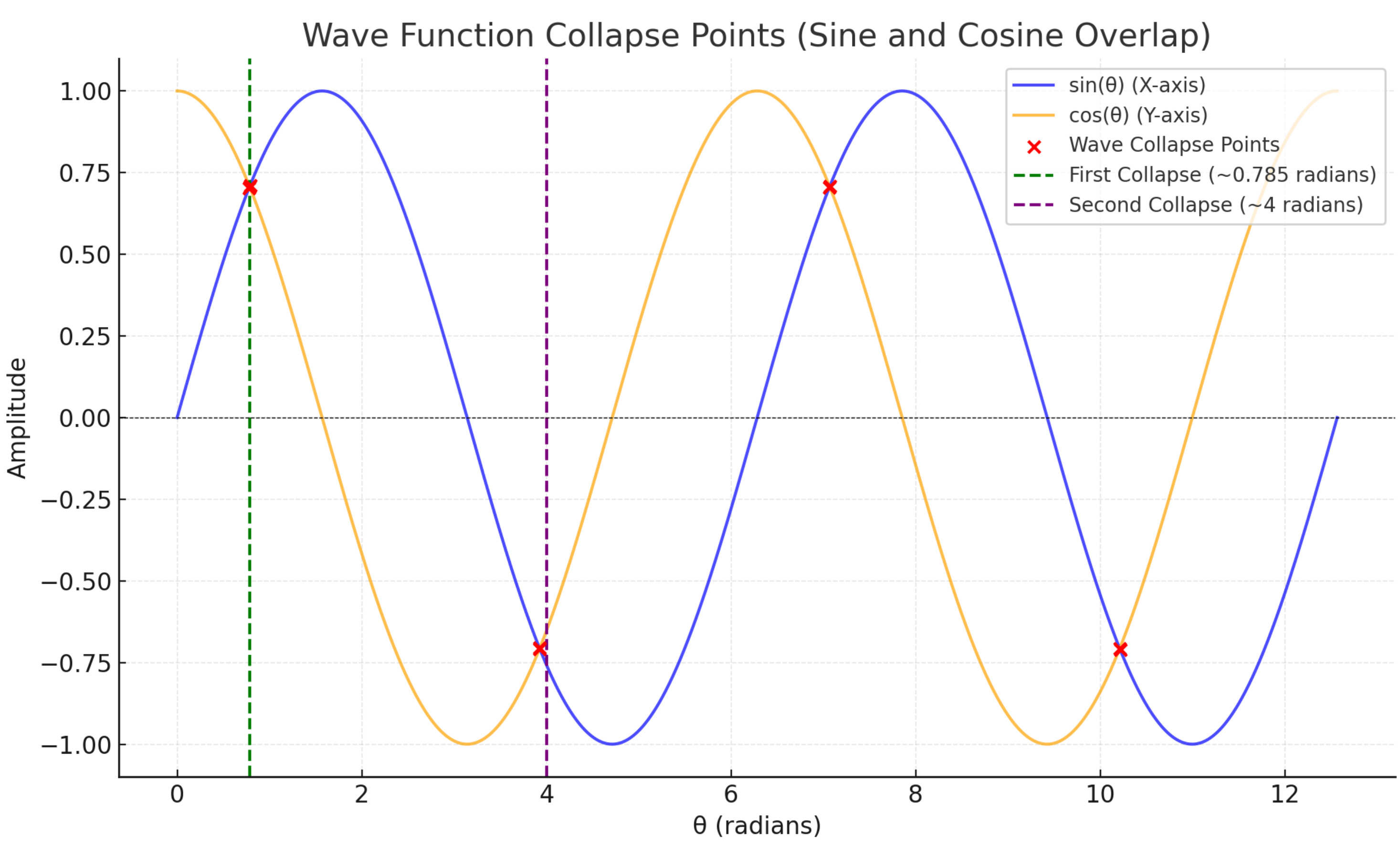
```
plt.plot(theta, y, label="cos(θ) (Y-axis)", color='orange', alpha=0.7)

# Highlight the wave collapse points
plt.scatter(theta[collapse_points], x[collapse_points], color='red',
label="Wave Collapse Points", zorder=5)

# Highlight the specific overlap points
plt.axvline(np.pi / 4, color='green', linestyle="--", label="First Collapse
(~0.785 radians)")

plt.axvline(4, color='purple', linestyle="--", label="Second Collapse (~4
radians)")

# Formatting the plot
plt.title("Wave Function Collapse Points (Sine and Cosine Overlap)")
plt.xlabel("θ (radians)")
plt.ylabel("Amplitude")
plt.axhline(0, color='black', linewidth=0.5, linestyle="--")
plt.legend()
plt.grid(alpha=0.3)
plt.tight_layout()
plt.show()
```



React Visual

```
import React, { useState, useEffect } from 'react';
import { LineChart, Line, XAxis, YAxis, CartesianGrid, Tooltip, Legend,
ResponsiveContainer, ReferenceLine } from 'recharts';
import { Card, CardHeader, CardTitle, CardContent } from
'@/components/ui/card';
import { Slider } from '@/components/ui/slider';

const WaveCollapseViz = () => {
  const [angle, setAngle] = useState(45);
  const [data, setData] = useState([]);

  useEffect(() => {
    // Generate wave data with higher precision
    const newData = [];
    for (let t = 0; t <= 360; t += 2) {  // Increased resolution
      const radians = (t * Math.PI) / 180;
      newData.push({
        angle: t,
        sine: Math.sin(radians),
        cosine: Math.cos(radians),
        product: Math.sin(radians) * Math.cos(radians),
        rms: Math.sqrt((Math.pow(Math.sin(radians), 2) +
Math.pow(Math.cos(radians), 2)) / 2)
      });
    }
    setData(newData);
  }, []);

  const getCurrentValues = () => {
    const radians = (angle * Math.PI) / 180;
    const sin = Math.sin(radians);
    const cos = Math.cos(radians);
    return {
      sine: sin.toFixed(6),
      cosine: cos.toFixed(6),
      product: (sin * cos).toFixed(6),
      sinSquared: Math.pow(sin, 2).toFixed(6),
      cosSquared: Math.pow(cos, 2).toFixed(6),
      rms: Math.sqrt((Math.pow(sin, 2) + Math.pow(cos, 2)) / 2).toFixed(6)
    };
  };

  const values = getCurrentValues();
```

```
  return (
    <Card className="w-full">
      <CardHeader>
        <CardTitle>Wave Function Collapse Visualization</CardTitle>
      </CardHeader>
      <CardContent>
        <div className="space-y-6">
          <div className="flex flex-col space-y-2">
            <label className="text-sm font-medium">Angle: {angle}°</label>
            <Slider
              value={[angle]}
              onValueChange={(value) => setAngle(value[0])}
              min={0}
              max={360}
              step={1}
            />
          </div>

          <div className="grid grid-cols-2 md:grid-cols-3 lg:grid-cols-6 gap-
4">
            <div className="p-4 bg-blue-100 rounded-lg">
              <div className="text-sm font-medium text-blue-800">sin(θ)</div>
              <div className="text-lg font-bold text-blue-900">{values.sine}
</div>
            </div>
            <div className="p-4 bg-green-100 rounded-lg">
              <div className="text-sm font-medium text-green-800">cos(θ)</div>
              <div className="text-lg font-bold text-green-900">
{values.cosine}</div>
            </div>
            <div className="p-4 bg-purple-100 rounded-lg">
              <div className="text-sm font-medium text-purple-
800">sin(θ)cos(θ)</div>
              <div className="text-lg font-bold text-purple-900">
{values.product}</div>
            </div>
            <div className="p-4 bg-red-100 rounded-lg">
              <div className="text-sm font-medium text-red-800">sin²(θ)</div>
              <div className="text-lg font-bold text-red-900">
{values.sinSquared}</div>
            </div>
            <div className="p-4 bg-indigo-100 rounded-lg">
              <div className="text-sm font-medium text-indigo-800">cos²(θ)
</div>
              <div className="text-lg font-bold text-indigo-900">
```

```
{values.cosSquared}</div>
            </div>
            <div className="p-4 bg-orange-100 rounded-lg">
              <div className="text-sm font-medium text-orange-800">RMS</div>
              <div className="text-lg font-bold text-orange-900">{values.rms}
</div>
            </div>
          </div>

          <div className="h-96">
            <ResponsiveContainer width="100%" height="100%">
              <LineChart data={data} margin={{ top: 5, right: 30, left: 20,
bottom: 5 }}>
                <CartesianGrid strokeDasharray="3 3" />
                <XAxis
                  dataKey="angle"
                  label={{ value: 'Angle (degrees)', position: 'bottom' }}
                  domain={[0, 360]}
                  ticks={[0, 45, 90, 135, 180, 225, 270, 315, 360]}
                />
                <YAxis
                  domain={[-1, 1]}
                  label={{ value: 'Amplitude', angle: -90, position:
'insideLeft' }}
                  ticks={[-1, -0.5, 0, 0.5, 1]}
                />
                <Tooltip
                  formatter={(value) => value.toFixed(6)}
                  labelFormatter={(label) => `${label}°`}
                />
                <Legend />
                <ReferenceLine y={0} stroke="#666" strokeDasharray="3 3" />
                <ReferenceLine x={45} stroke="#666" strokeDasharray="3 3" />
                <Line
                  type="monotone"
                  dataKey="sine"
                  stroke="#2563eb"
                  name="sin(θ)"
                  dot={false}
                  strokeWidth={2}
                />
                <Line
                  type="monotone"
                  dataKey="cosine"
                  stroke="#16a34a"
                  name="cos(θ)"
```

```
                dot={false}
                strokeWidth={2}
              />
              <Line
                type="monotone"
                dataKey="product"
                stroke="#9333ea"
                name="sin(θ)cos(θ)"
                dot={false}
                strokeWidth={2}
              />
              <Line
                type="monotone"
                dataKey="rms"
                stroke="#ea580c"
                name="RMS"
                dot={false}
                strokeWidth={2}
              />
            </LineChart>
          </ResponsiveContainer>
        </div>
      </div>
    </CardContent>
  </Card>
  );
};

export default WaveCollapseViz;
```

Angle: 45°

sin(θ)
0.707107

cos(θ)
0.707107

sin(θ)cos(θ)
0.500000

sin²(θ)
0.500000

cos²(θ)
0.500000

RMS
0.707107