

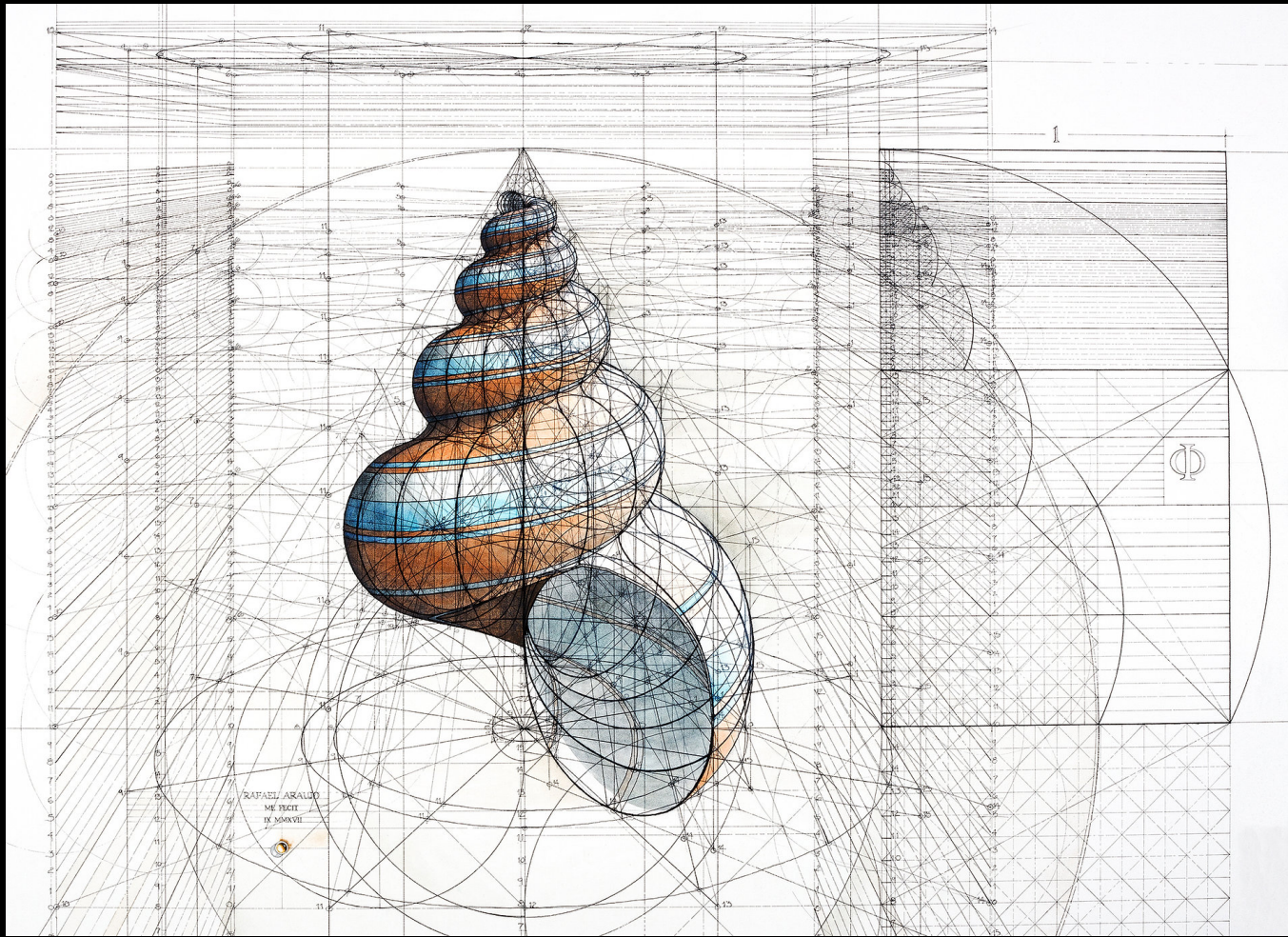
The Beauty of Mathematics

Background and Ideation

Inspiration

Since childhood, I have been deeply passionate about both mathematics and art. Although mathematics, with its inclination towards rational thinking, and art, with its emphasis on emotional expression, seem like two parallel lines that never intersect, I have discovered that these two disciplines actually complement and enhance each other on my learning journey. They are intricately intertwined. Through this project, I aim to explore the underlying connections between mathematics and art, attempting to visualize and concretely experiment with abstract concepts.

RAFAEL ARAUJO (Reference Artist)



MONARCH 1



GOLDEN SHELL

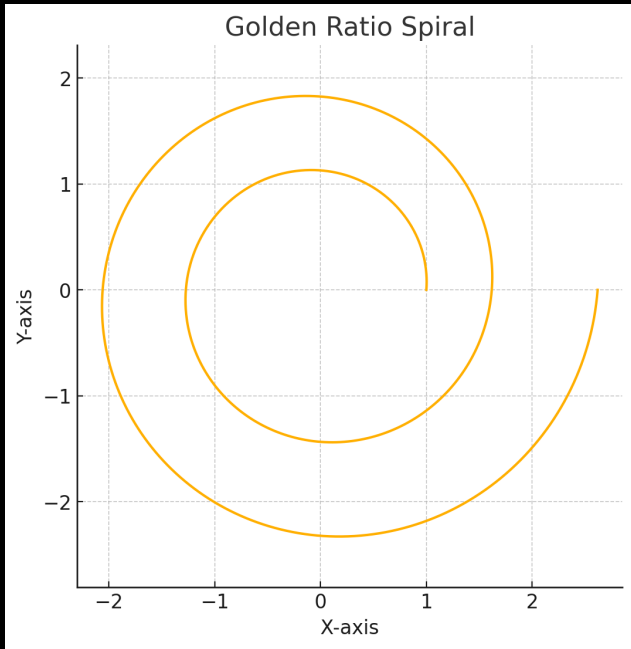
#Golden Spiral/ Fibonacci Sequence/ Sine and Circular Functions

Rafael Araujo's work emphasizes the perfection of geometry, combining mathematical aesthetic principles to create visually intricate compositions. Many of his pieces are meticulously hand-drawn, adhering strictly to mathematical function calculations.

Golden Ratio

Formula:

$$\varphi = \frac{1 + \sqrt{5}}{2} \approx 1.618$$

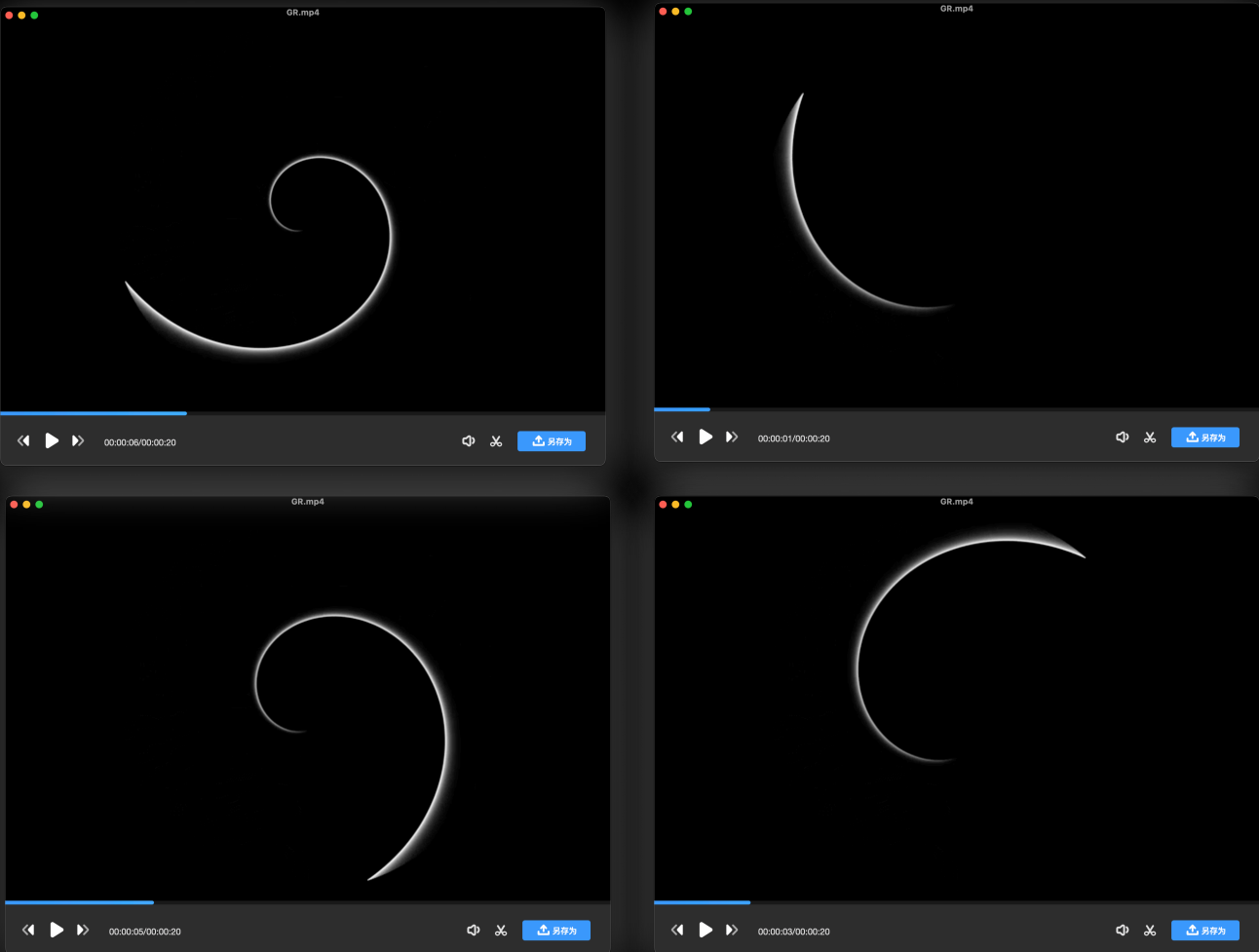


#Html Coding Process

```
<html>
<body>
  <script>
    function drawCurve() {
      curves.forEach((curve, i) => {
        const ctx = canvas.getContext('2d');
        // Path effect
        ctx.fillStyle = 'rgba(255, 255, 255, 0.1)';
        ctx.fillRect(0, 0, canvas.width, canvas.height);
        // Calculate new point
        const x = Math.sin(curve.time * curve.freq) * (canvas.width * 0.35) + canvas.width / 2;
        const y = Math.cos(curve.time * curve.freq) * (canvas.height * 0.35) + canvas.height / 2;
        curve.trail.push(x, y);
        if (curve.trail.length > 200) {
          curve.trail.shift();
        }
      });
    }
  </script>

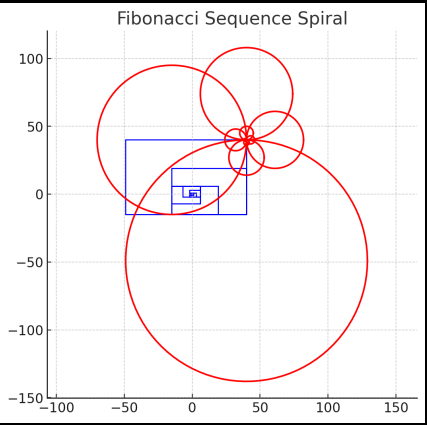
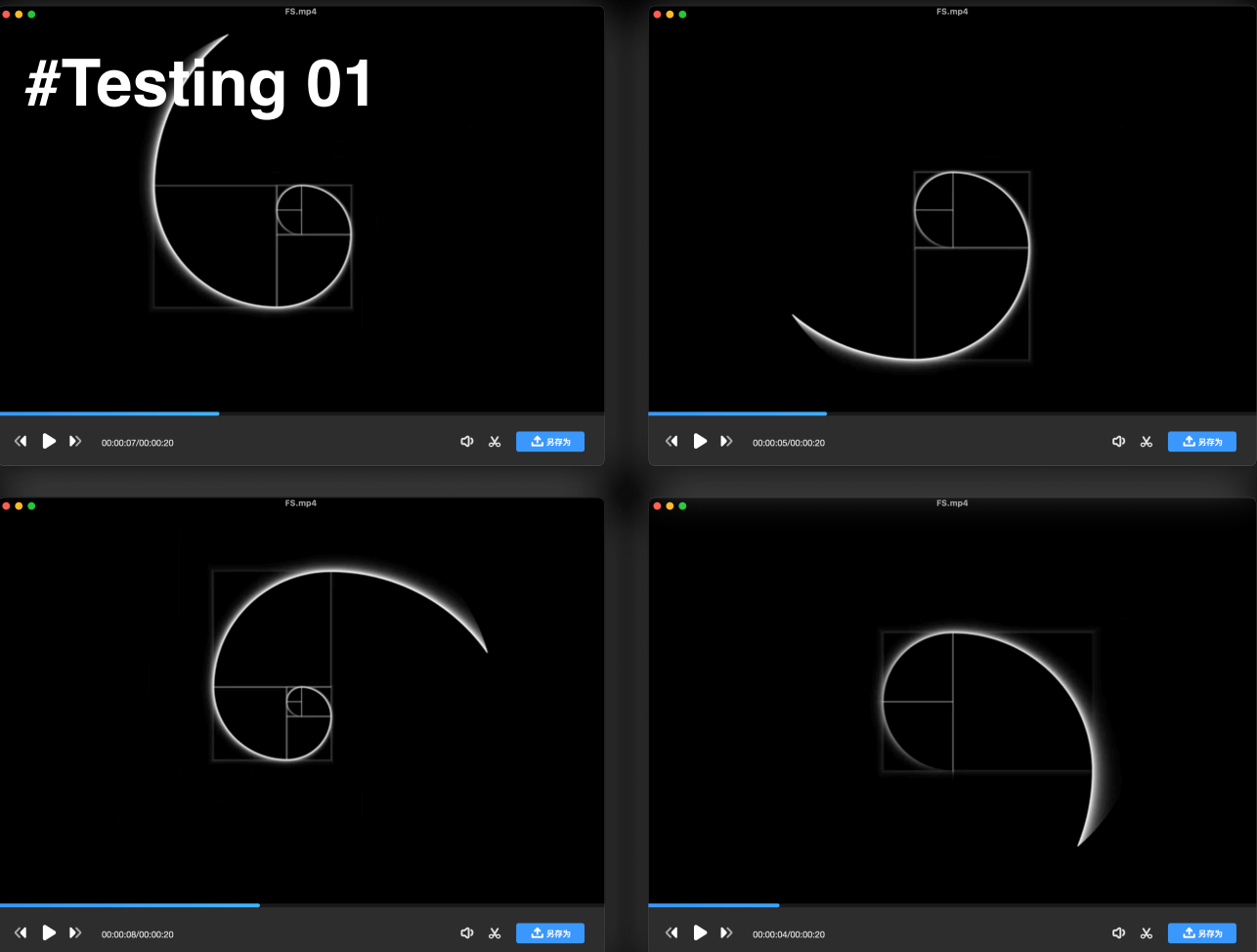
```

#Testing 01



#Golden Ratio Animation Generated

I used digital forms to present the dynamic display of the **Golden Ratio** and **Fibonacci Sequence**, and discovered that their aesthetic patterns and regularities are very similar. This inspired me to experiment with a new mathematical function, the **Lissajous Curve**, to explore more variations.



Formula:

$$F(n) = F(n - 1) + F(n - 2)$$
$$F(0) = 0, \quad F(1) = 1$$

Fibonacci Sequence

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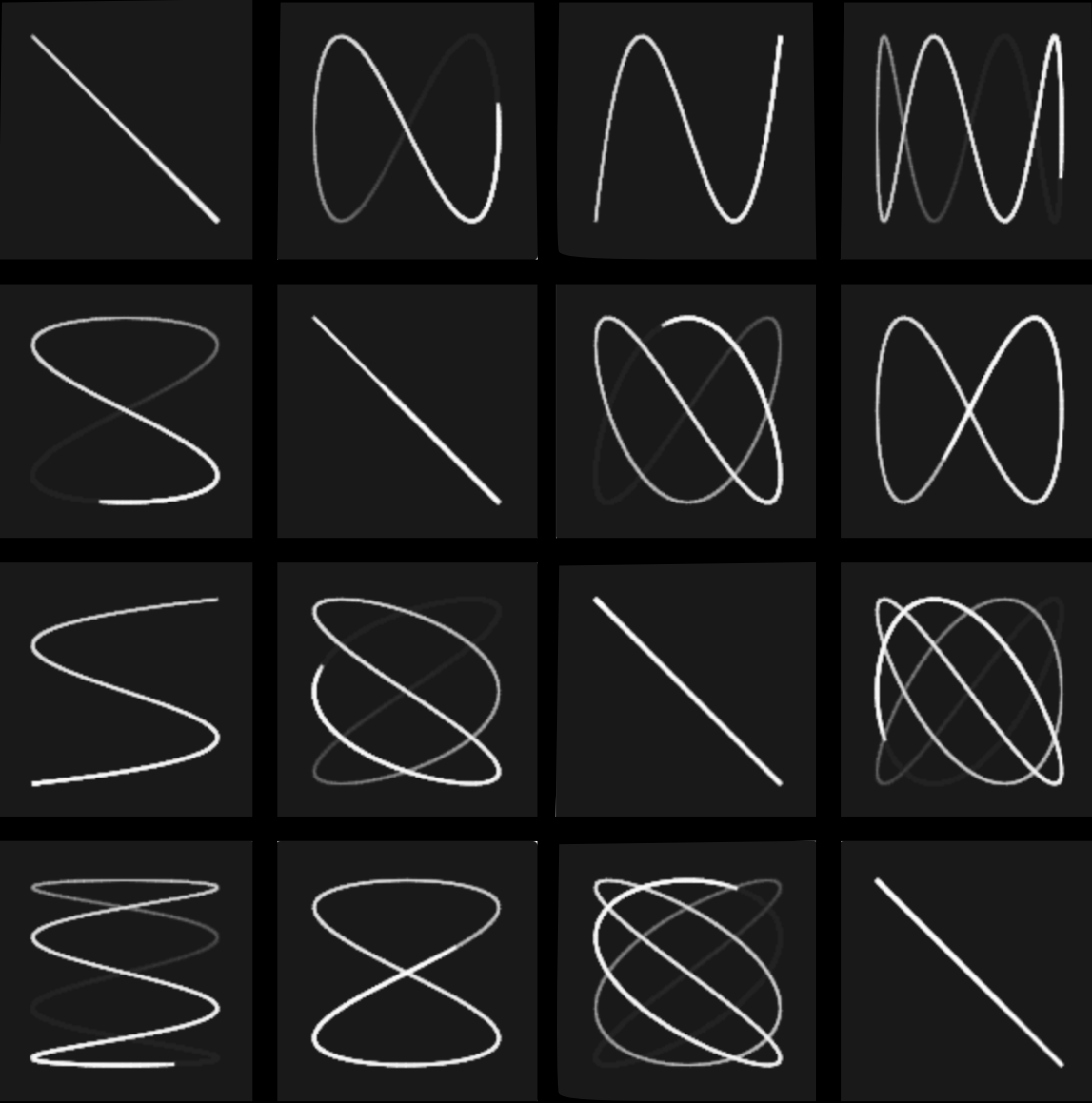
Testing and Coding

Lissajous Curve

Formula:

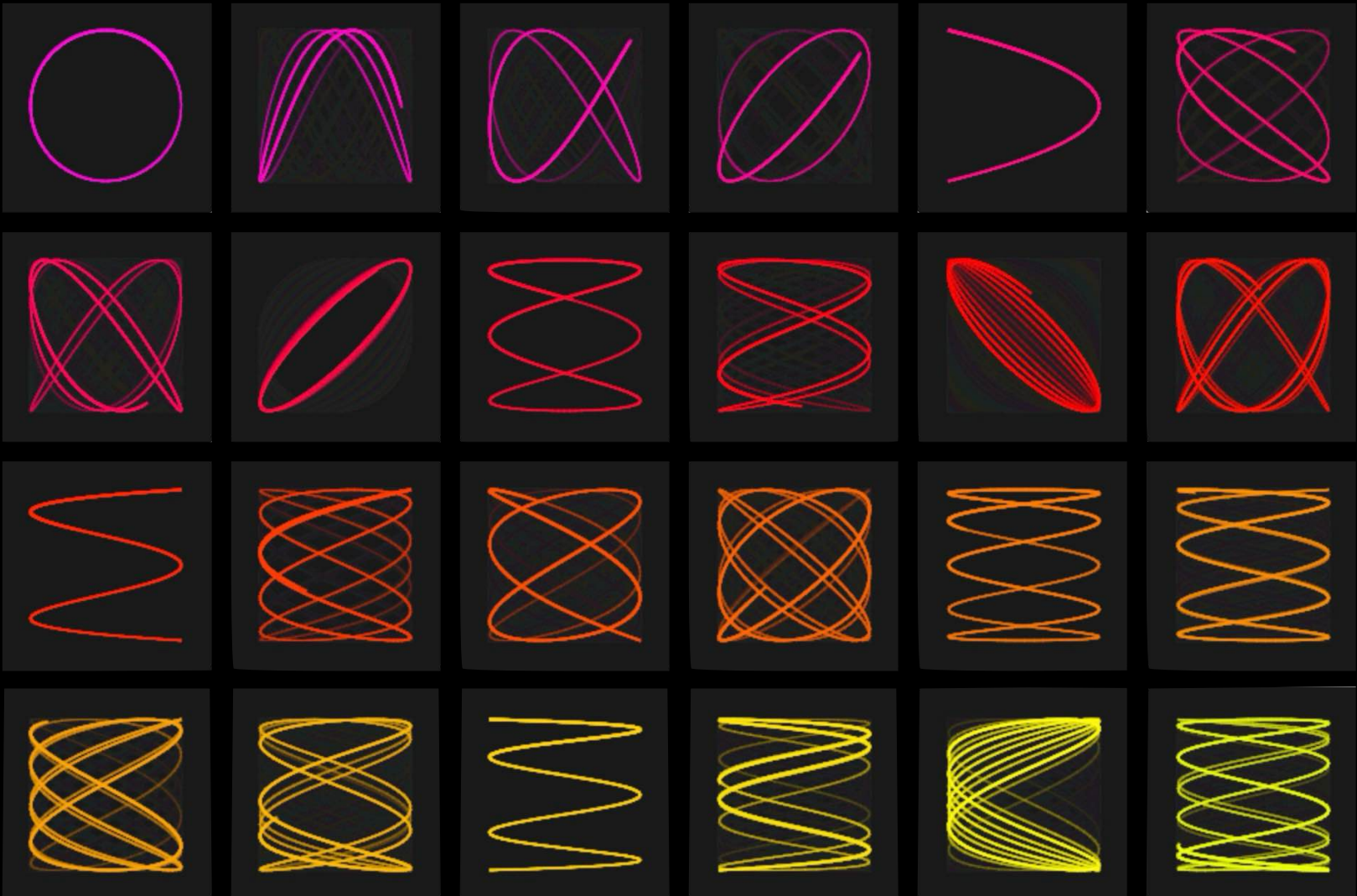
$$x(t) = A \sin(at + \delta), \quad y(t) = B \sin(bt)$$

#Testing 01 (a/b +)



Based on the logic of the **Lissajous curve** function, generate a 4x4 grid of visual dynamic images using code logic. The principle of change is to fix the values of A and B to determine the amplitude, and for each image, change the frequencies 'a' and 'b' to achieve visual variation

#Testing 02 (add delta with random b, hue +)

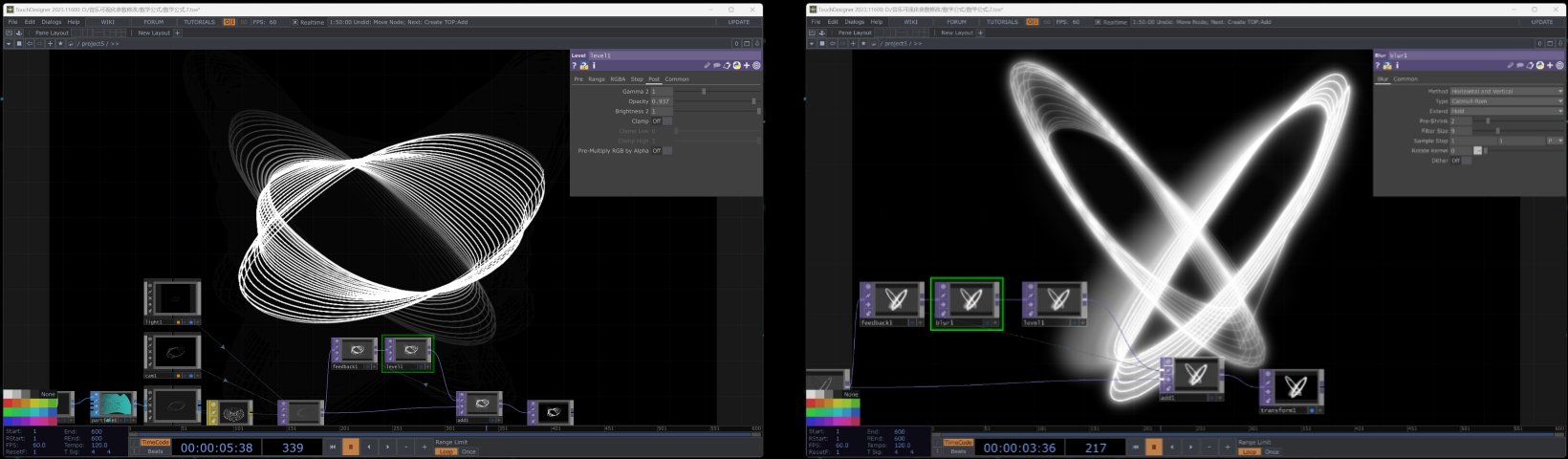
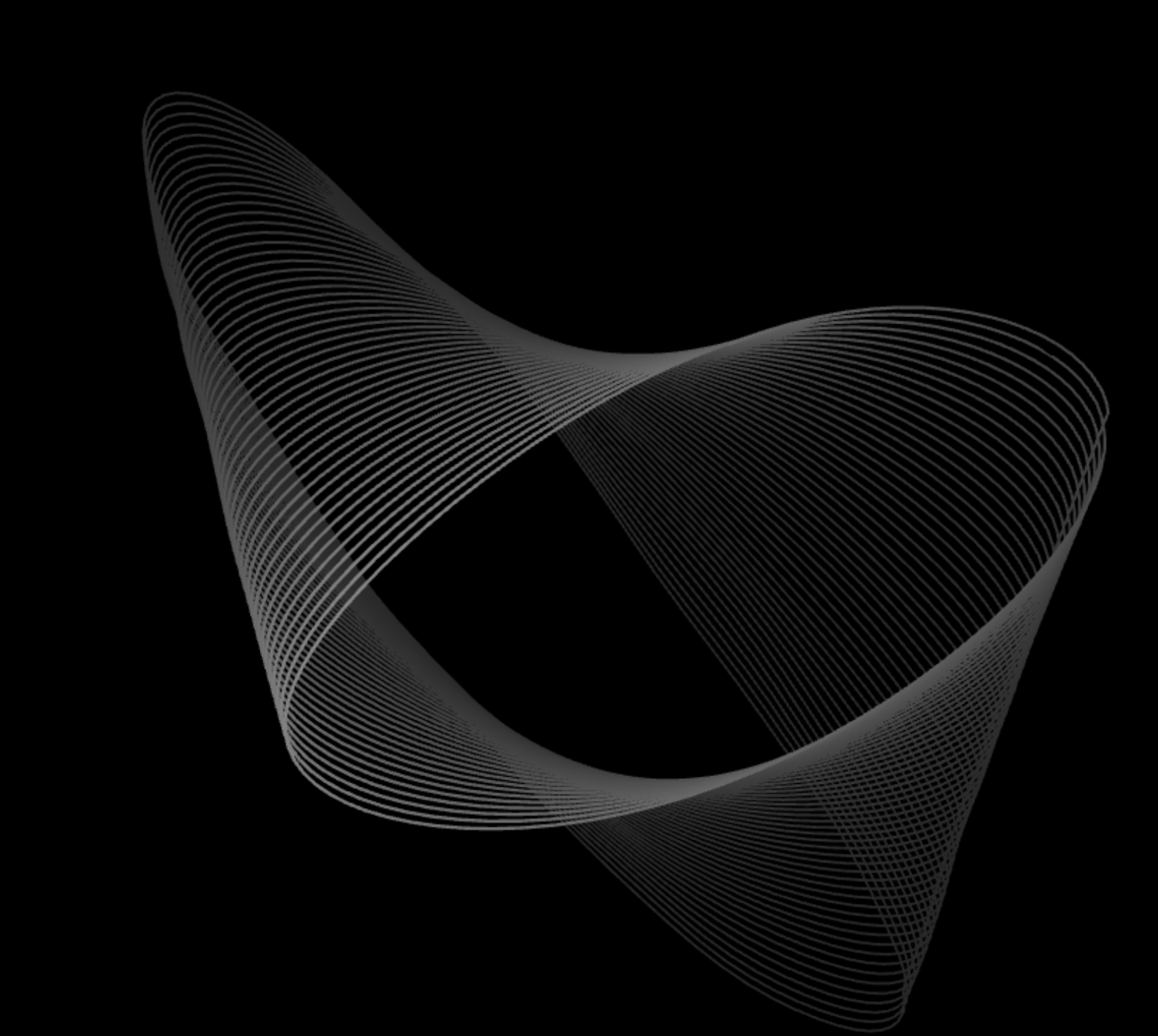


Based on Testing01, Delta was added, b was made random, and incremental color hues were introduced while maintaining different brightness levels.

```
2 // main
3 // body
4 // script
5 function drawCurve() {
6   curve.moveTo(0, 0);
7   const ctx = curve.ctx;
8   // Path effect
9   ctx.fillStyle = 'rgb(20, 20, 20, 0.1)';
10  ctx.fillRect(0, 0, canvasSize, canvasSize);
11  // Calculate new point
12  const t = Math.sin(curve.time * curve.freq) * (canvasSize * 0.35) + canvasSize / 2;
13  const y = Math.sin(curve.time * curve.freq) * (canvasSize * 0.35) + canvasSize / 2;
14  curve.push(t, y);
15  if (curve.length > 200) {
16    curve.shift();
17  }
18  // Draw trail
19  ctx.beginPath();
20  ctx.moveTo(curve[0].x, curve[0].y);
21  for (let i = 1; i < curve.length; i++) {
22    const alpha = i / curve.length;
23    ctx.strokeStyle = 'rgb(255, 255, 255, 0.1 * alpha)';
24    ctx.lineWidth = alpha * 2;
25    ctx.lineTo(curve[i].x, curve[i].y);
26    ctx.stroke();
27    ctx.moveTo(curve[i].x, curve[i].y);
28  }
29 }
```

#Html Coding Process

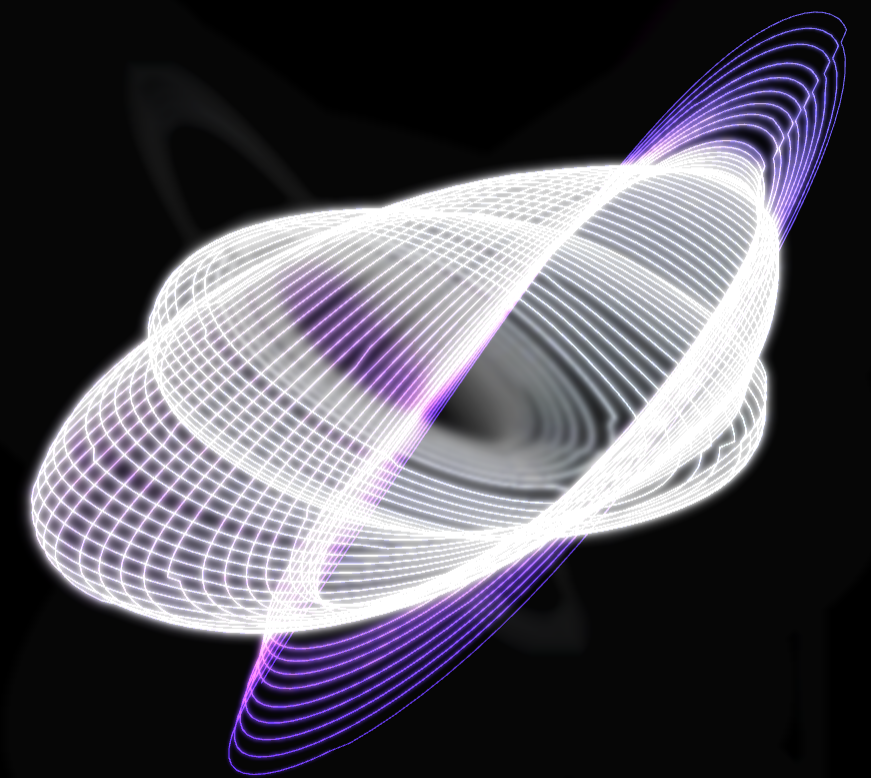
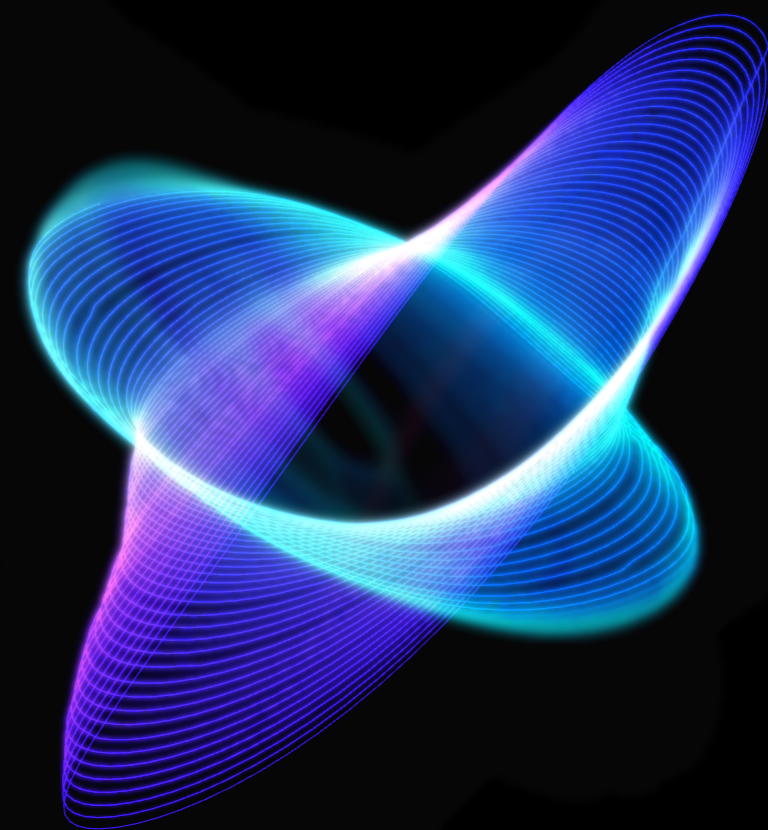
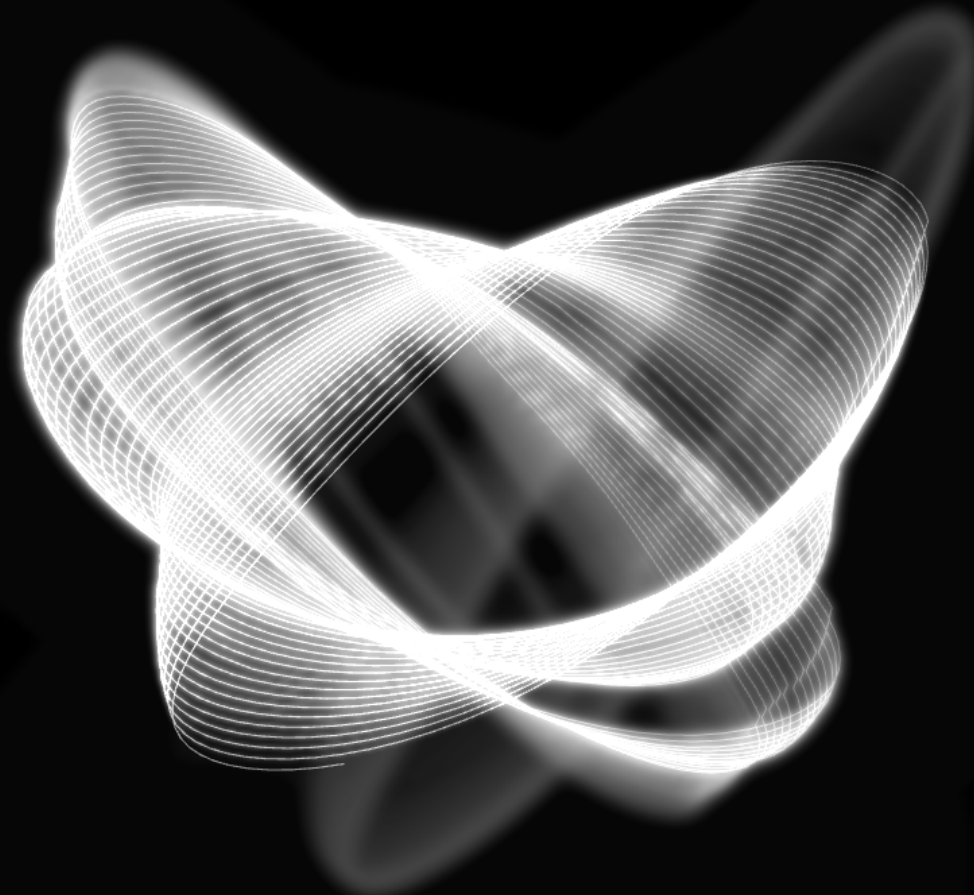
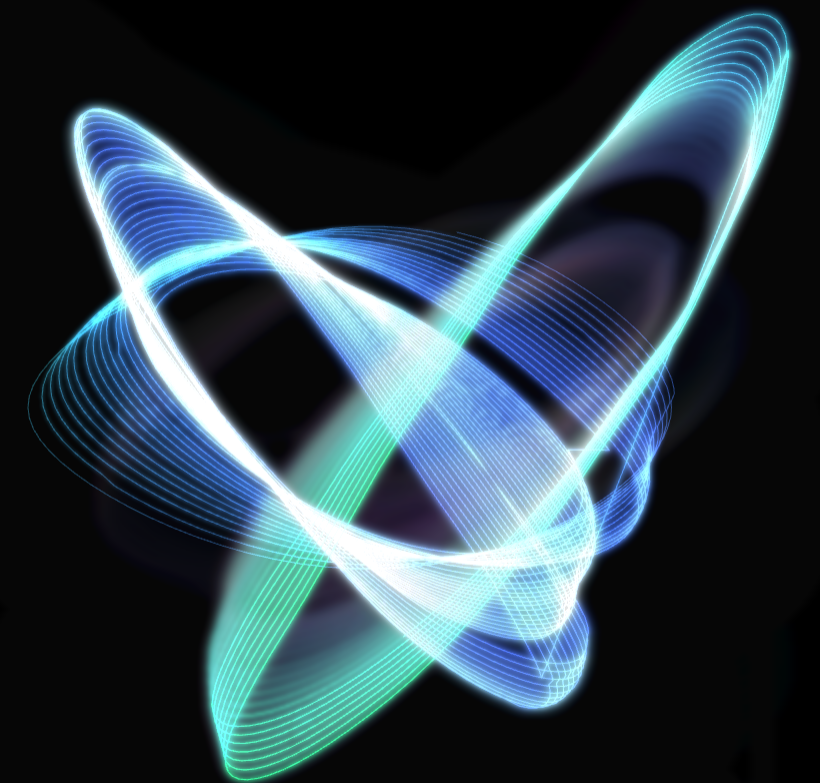
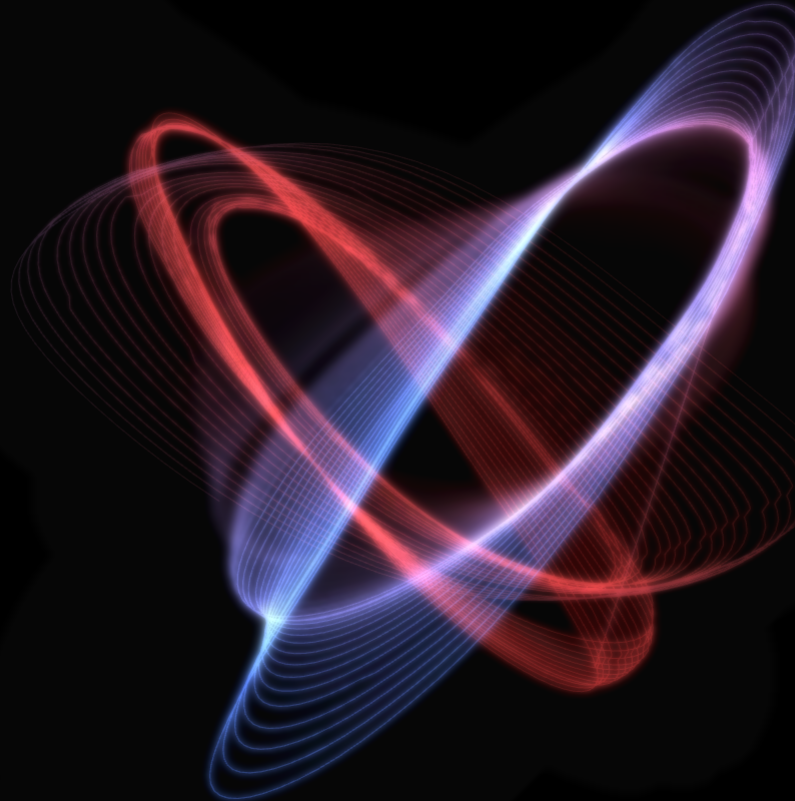
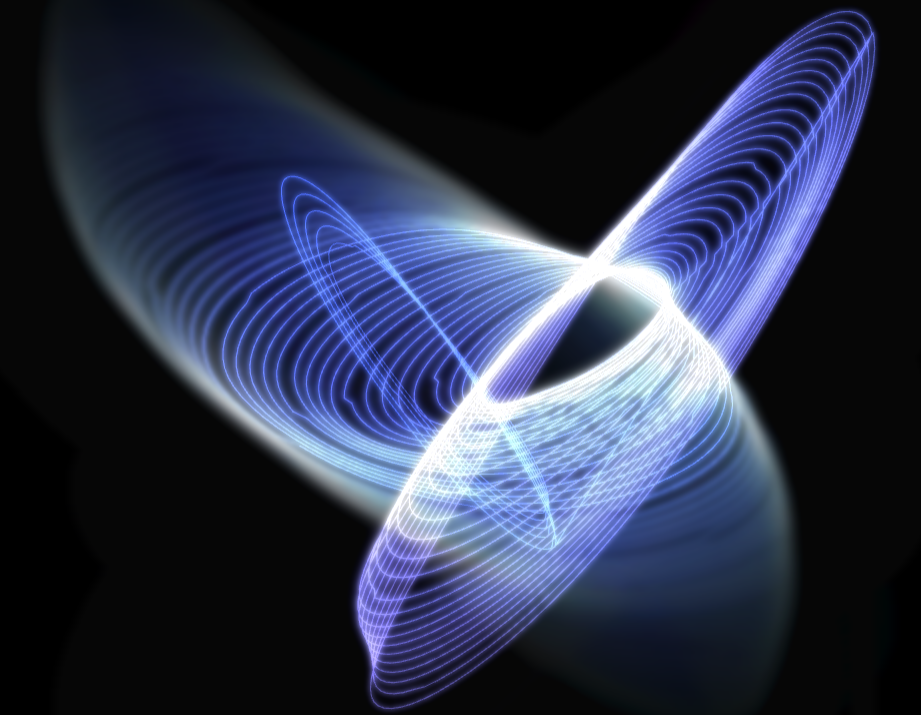
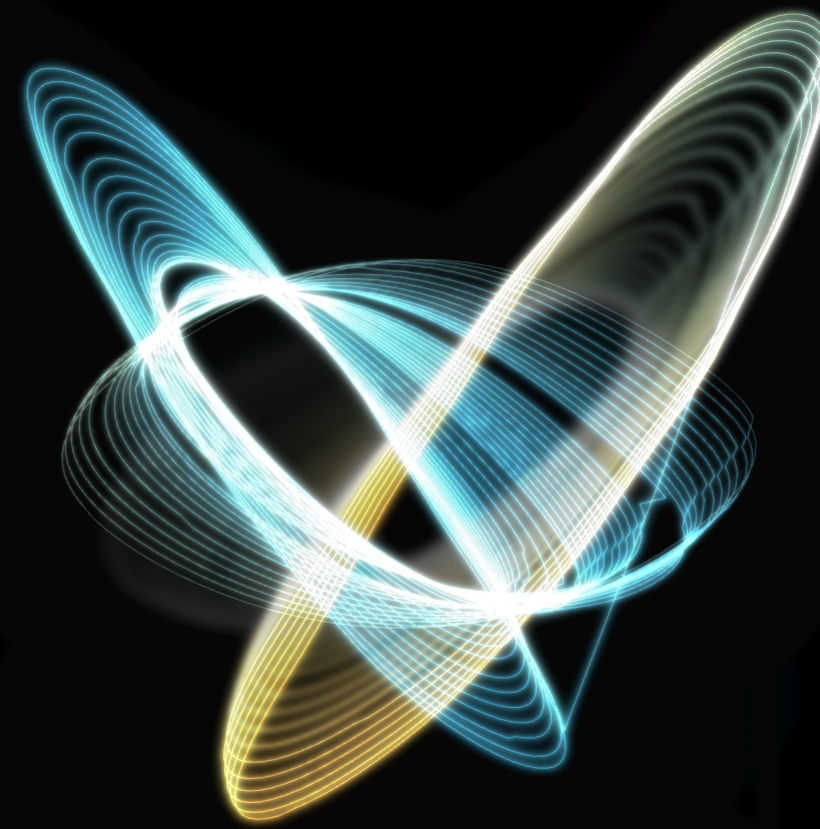
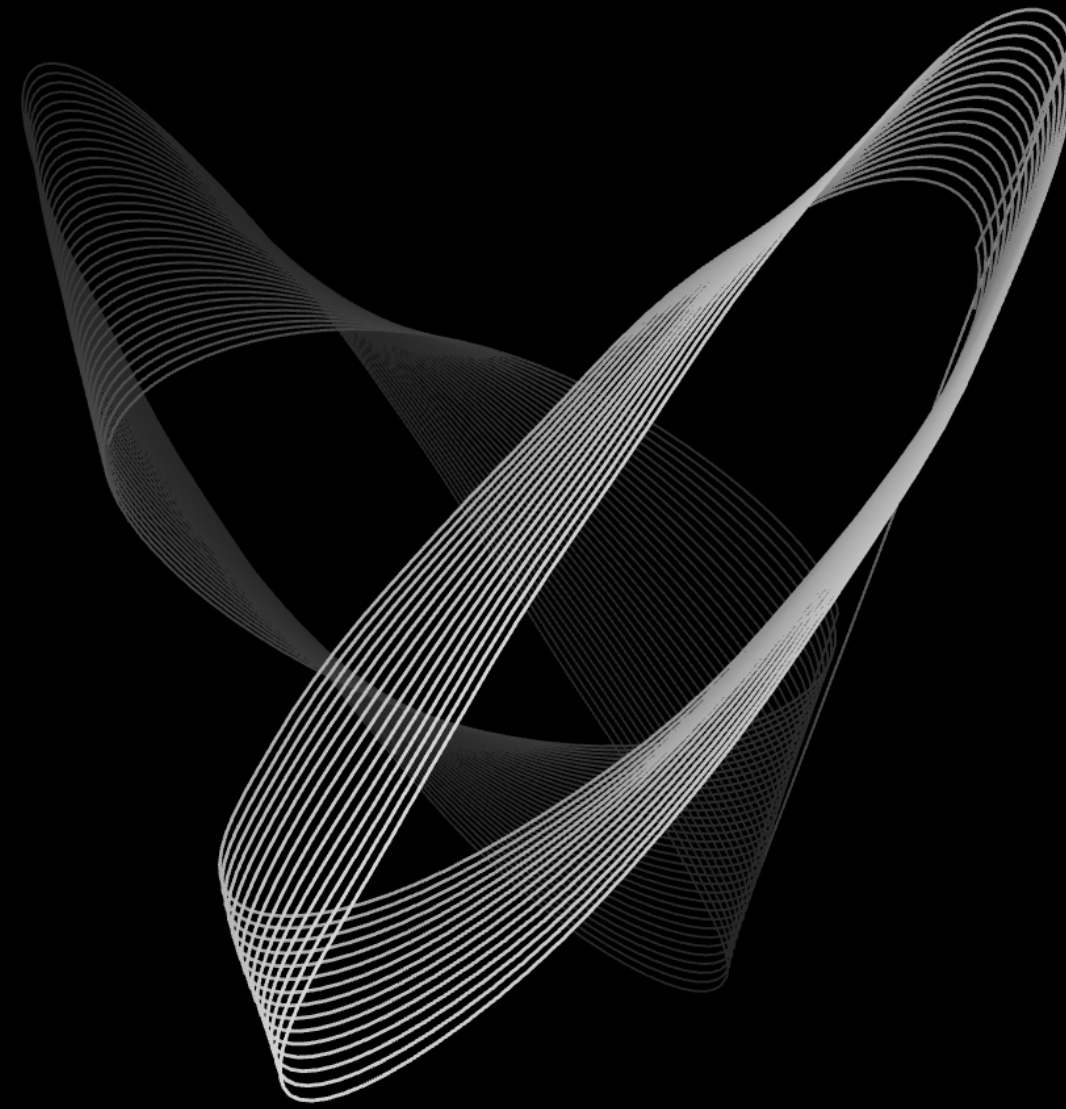
#Testing 03 (3D Rendering)



#Touch Designer Modeling and Rendering

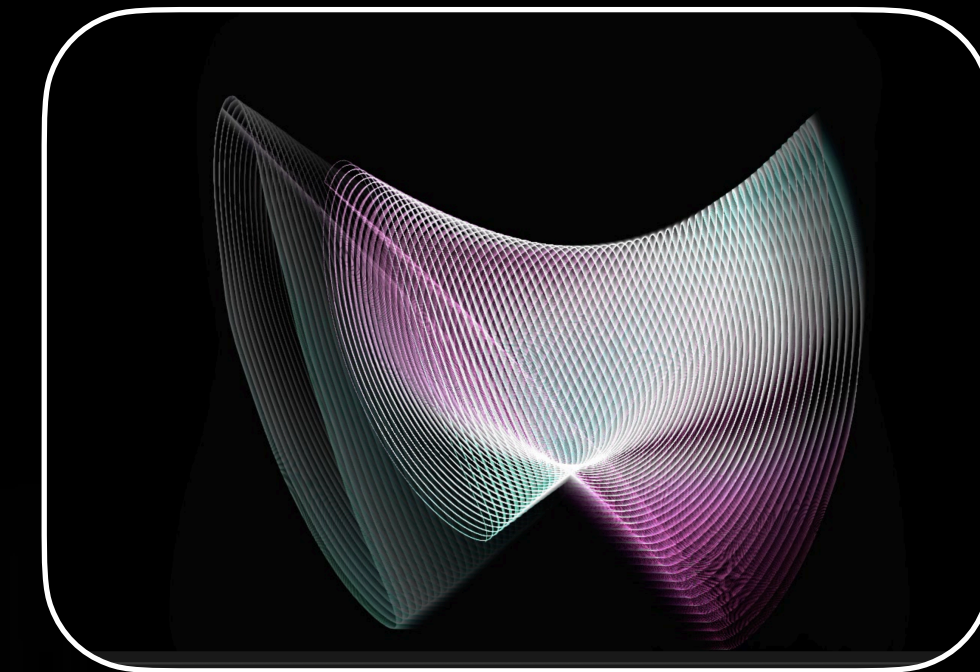
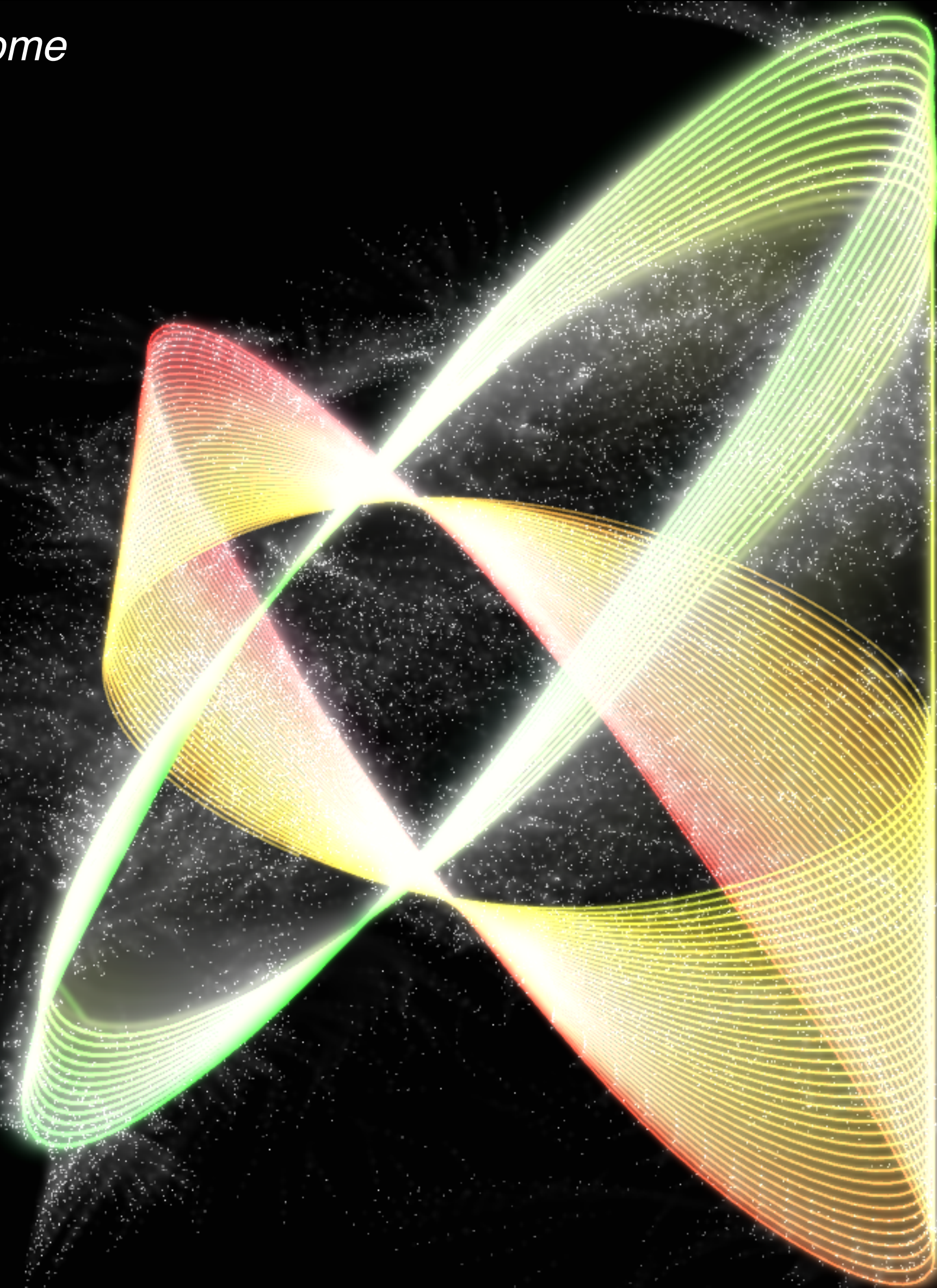
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Lissajous Curve Development



The Beauty of Mathematics

Final Outcome



#Lissajous Curve

Duration: 01:01

Link to Video:

<https://youtu.be/GM1dkJESiZ4>

Coding and Editing Techniques:

CapCut/ Html/ Touchdesigner/ Photoshop