

melancholic bioluminescence

you actually opened the file and read all of my documentation!!!! thank you
because I spend a lot of time documenting and I hope my efforts get
matched with equal curiosity

Global State Variables

$$\begin{aligned} t &= \text{frameCount} \times 0.008 && \text{(time scalar)} \\ C &= \text{clamp}\left(\frac{\text{millis}() - t_{\text{hold}}}{5500}, 0, 1\right) && \text{(charge level)} \\ P_{\text{expl}} &= \text{clamp}\left(\frac{\text{millis}() - t_{\text{explode}}}{D}, 0, 1\right), \quad D = \text{lerp}(1400, 4000, C) && \text{(explosion progress)} \end{aligned}$$

System Overview

Particle Drift (Idle / Flow Field)

Each particle samples a Perlin noise field to get a drift angle:

$$\theta_{\text{noise}} = \text{noise}(x \cdot n_s + n_{ox}, y \cdot n_s + n_{oy}, t \cdot 0.5) \times 4\pi \quad (1)$$

$$\vec{d} = \begin{pmatrix} \cos \theta_{\text{noise}} \\ \sin \theta_{\text{noise}} \end{pmatrix} \times v_{\text{drift}} \quad (2)$$

A sinusoidal wobble is added:

$$\vec{w} = \begin{pmatrix} \sin(t \cdot f_w + n_{ox}) \\ \cos(t \cdot f_w \cdot 0.7 + n_{oy}) \end{pmatrix} \times A_w \quad (3)$$

Velocity update each frame:

$$\vec{v} \leftarrow (\vec{v} + \vec{d} \cdot 0.07 + \vec{w} \cdot 0.03) \times k_{\text{drag}}, \quad k_{\text{drag}} \in [0.93, 0.97] \quad (4)$$

Algorithm 1 Main Draw Loop

```
1:  $t \leftarrow \text{frameCount} \times 0.008$ 
2: Apply screen shake:  $\text{translate}(\text{rand}(\pm s), \text{rand}(\pm s))$  where  $s = \sigma + \rho$ 
3:  $\sigma \leftarrow \sigma \times 0.86$  ▷ decay screen shake
4: if holding then
5:    $\rho \leftarrow \text{lerp}(\rho, (C - 0.6) \times 8, 0.1)$  ▷ rumble ramps after 60% charge
6: else
7:    $\rho \leftarrow \rho \times 0.9$ 
8: end if
9: background(0) ▷ clear to black each frame
10: Update cursor smooth position:  $\vec{s} \leftarrow \text{lerp}(\vec{s}, \vec{m}, 0.08)$  where  $\vec{m} = (\text{mouseX}, \text{mouseY})$ 
11: Update  $C$  from elapsed time
12: Spawn particles if holding (rate scales with  $C$ )
13: Compute glow radius target  $G^*$  from state
14:  $G \leftarrow \text{lerp}(G, G^*, 0.16)$ 
15: Draw glow at  $G$ 
16: Draw vortex arms if holding and  $C > 0.08$ 
17: Update and draw trails, embers
18: for each particle  $p$  do
19:    $p.\text{update}(t, \text{state})$ 
20:    $p.\text{draw}(t)$ 
21: end for
22: Draw cursor core if holding
```

Algorithm 2 Particle Suction Toward Cursor

```
1:  $\vec{\delta} \leftarrow \vec{s} - \vec{p}$  ▷ vector from particle to cursor
2:  $d \leftarrow \max(|\vec{\delta}|, 8)$ 
3:  $\hat{n} \leftarrow \vec{\delta}/d$ 
4: Pull magnitude:

$$F_{\text{pull}} = \text{clamp}(\text{map}(d, 0, 500, 3.2, 0.1), 0.08, 4) \times \text{lerp}(0.18, 2.8, C^{0.65})$$

5: Tangential vortex direction:  $\hat{t} = (-\hat{n}_y, \hat{n}_x)$ 
6:  $V_{\text{vortex}} = \text{lerp}(0.4, 2.2, C^{0.65})$ 
7: Perturb  $\hat{n}$  by noise angle  $\phi \in (-0.5, 0.5)\pi$ 
8:  $\vec{v} \leftarrow \vec{v} + \hat{n}_{\text{perturbed}} \cdot F_{\text{pull}} \cdot 0.4 + \hat{t} \cdot V_{\text{vortex}} \cdot 0.1$ 
9: Add orbital component:  $\vec{v} \leftarrow \vec{v} + (-\hat{n}_y, \hat{n}_x) \cdot \omega \cdot d \cdot 0.22 \cdot 0.015$ 
10: if  $d < r_{\text{compress}}$  then ▷  $r_{\text{compress}} = \text{lerp}(60, 20, C)$ 
11:   Compress size and boost alpha
12: end if
13: if  $d < 12$  then mark particle as absorbed
14: end if
```

Particle Update During Charge (Suction Phase)

Explosion Trigger

On mouse release, charge tier is assigned:

$$\tau = \begin{cases} 0 & C < 0.25 \\ 1 & 0.25 \leq C < 0.55 \\ 2 & 0.55 \leq C < 0.85 \\ 3 & C \geq 0.85 \end{cases} \quad (5)$$

Blast radius and max force per tier:

$$R_{\text{blast}} \in \{80, 250, 500, 800\} \quad (6)$$

$$F_{\text{max}} \in \{1.5, 8, 18, 35\} \quad (7)$$

Force applied to each particle within R_{blast} :

$$F_i = F_{\text{max}} \cdot \left(1 - \frac{d_i}{R_{\text{blast}}}\right)^2 \cdot v_{\text{expl},i} \quad (8)$$

$$\vec{v}_i \leftarrow \vec{v}_i + F_i \cdot \begin{pmatrix} \cos \theta_i \\ \sin \theta_i \end{pmatrix}, \quad \theta_i = \text{atan2}(\Delta y_i, \Delta x_i) + \epsilon_{\text{noise}} \quad (9)$$

Post-Explosion Particle Behaviors

Algorithm 3 Behavior Assignment

- 1: $\lambda \leftarrow 1 - \text{clamp}(d/R_{\text{blast}}, 0, 1)$ ▷ closeness to blast center
 - 2: **if** $C > 0.85$ **then**
 - 3: **if** $\lambda > 0.7$ **then** prefer COMET or SPIRAL
 - 4: **else if** $\lambda > 0.3$ **then** mix of SPIRAL, BOOMERANG, FLUTTER
 - 5: **else** prefer RADIAL or FLUTTER
 - 6: **end if**
 - 7: **else if** $C > 0.5$ **then**
 - 8: mix of SPIRAL, COMET, RADIAL
 - 9: **else**
 - 10: mostly RADIAL, 15% chance SPIRAL
 - 11: **end if**
-

SPIRAL: A perpendicular force is added to curve trajectory:

$$\vec{v} \leftarrow \vec{v} + |\vec{v}| \cdot k_s \cdot (1 - P_{\text{expl}}) \cdot \hat{t}_{\perp} \quad (10)$$

BOOMERANG: After timer exceeds peak $\beta \in [0.3, 0.5]$, return force toward origin:

$$\vec{v} \leftarrow \vec{v} + 0.15 \cdot (\tau_b - \beta) \cdot \frac{\vec{o} - \vec{p}}{|\vec{o} - \vec{p}|} \quad (11)$$

FLUTTER: Oscillating lateral force, damped:

$$v_x += A_f \sin(t \cdot f_x + n_{ox}) \cdot 0.08, \quad v_y += A_f \cos(t \cdot f_y + n_{oy}) \cdot 0.08 \quad (12)$$

$$\vec{v} \leftarrow \vec{v} \times 0.985 \quad (13)$$

Glow Rendering

The glow is drawn as $N = 50$ concentric ellipses with radially decaying alpha:

$$r_i = 2G \cdot (0.8 \cdot \xi^2 + 0.2\xi), \quad \xi = \frac{i}{N - 1} \quad (14)$$

$$\alpha_i = 3.5 \cdot (1 - \xi)^{2.5} \quad (15)$$

Hue interpolates from cool to warm toward center:

$$H_{\text{base}} = \text{lerp}(240, 290, C \cdot 0.6) \quad (16)$$

Particle Rendering

Each particle draws three ellipses at sizes $4s$, $2s$, $0.6s$ with a breathing modulation:

$$s_{\text{render}} = s_{\text{base}} \cdot (1 + 0.15 \sin(t \cdot f_b + n_{ox})) \quad (17)$$

Alpha layers: $a \cdot 0.08$ (outer halo), $a \cdot 0.25$ (body), $a \cdot 0.8$ (bright core).