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 cursiosity

Global State Variables

$$t = \texttt{frameCount} \times 0.008 \qquad \text{(time scalar)}$$

$$C = \mathrm{clamp}\left(\frac{\texttt{millis()} - t_{\text{hold}}}{5500},\ 0,\ 1\right) \qquad \text{(charge level)}$$

$$P_{\text{expl}} = \mathrm{clamp}\left(\frac{\texttt{millis()} - t_{\text{explode}}}{D},\ 0,\ 1\right), \quad D = \mathrm{lerp}(1400, 4000, C) \qquad \text{(explosion progress)}$$

System Overview

Particle Drift (Idle / Flow Field)

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

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

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

A sinusoidal wobble is added:

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

Velocity update each frame:

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

Algorithm 1 Main Draw Loop

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

Algorithm 2 Particle Suction Toward Cursor

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

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

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

Particle Update During Charge (Suction Phase)

Explosion Trigger

On mouse release, charge tier is assigned:

$$\tau = \begin{cases} 0 & C < 0.25 \\ 1 & 0.25 \le C < 0.55 \\ 2 & 0.55 \le C < 0.85 \\ 3 & C \ge 0.85 \end{cases} \tag{5}$$

Blast radius and max force per tier:

$$R_{\text{blast}} \in \{80,\ 250,\ 500,\ 800\} \tag{6}$$

$$F_{\max} \in \{1.5,\ 8,\ 18,\ 35\} \tag{7}$$

Force applied to each particle within R_{blast}:

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

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

Post-Explosion Particle Behaviors

Algorithm 3 Behavior Assignment

$\lambda \leftarrow 1 - \text{clamp}(d/R_{\text{blast}},\ 0,\ 1)$ ▷ closeness to blast center
if $C > 0.85$ **then**
    if $\lambda > 0.7$ **then** prefer `COMET` or `SPIRAL`
    else if $\lambda > 0.3$ **then** mix of `SPIRAL`, `BOOMERANG`, `FLUTTER`
    else prefer `RADIAL` or `FLUTTER`
    end if
else if $C > 0.5$ **then**
    mix of `SPIRAL`, `COMET`, `RADIAL`
else
    mostly `RADIAL`, 15% chance `SPIRAL`
end if

SPIRAL: A perpendicular force is added to curve trajectory:

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

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

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

FLUTTER: Oscillating lateral force, damped:

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

$$\vec{v} \leftarrow \vec{v} \times 0.985 \tag{13}$$

Glow Rendering

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

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

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

Hue interpolates from cool to warm toward center:

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

Particle Rendering

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

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

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