Particle Systems

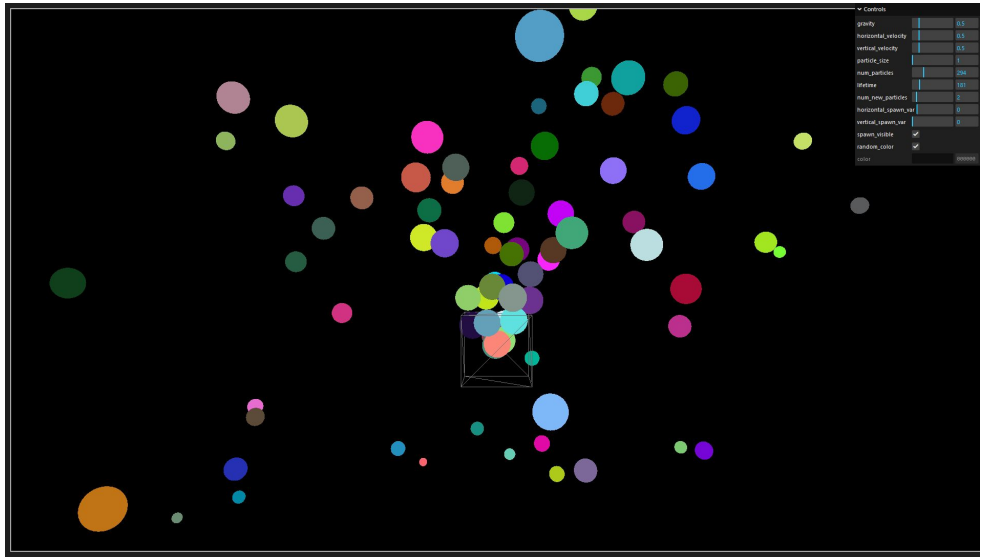
Particle System

Technique using small scale graphics objects to simulate certain phenomena

- Fire, smoke, water, clouds, etc.

Consists of three elements:

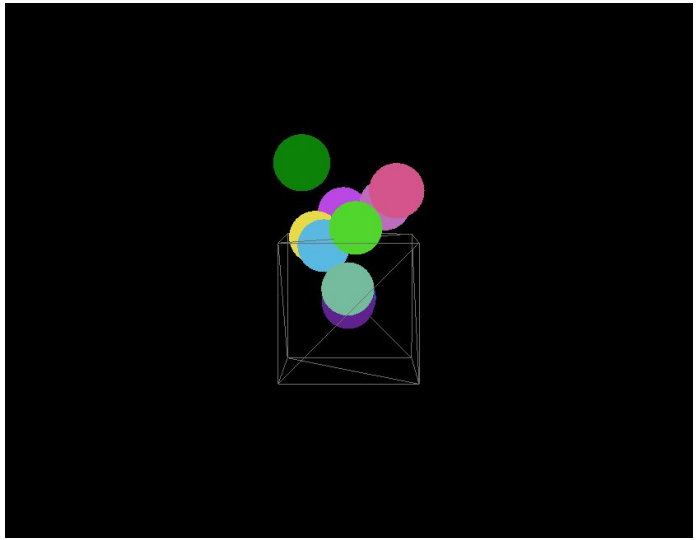
- Emission
- Simulation
- Rendering



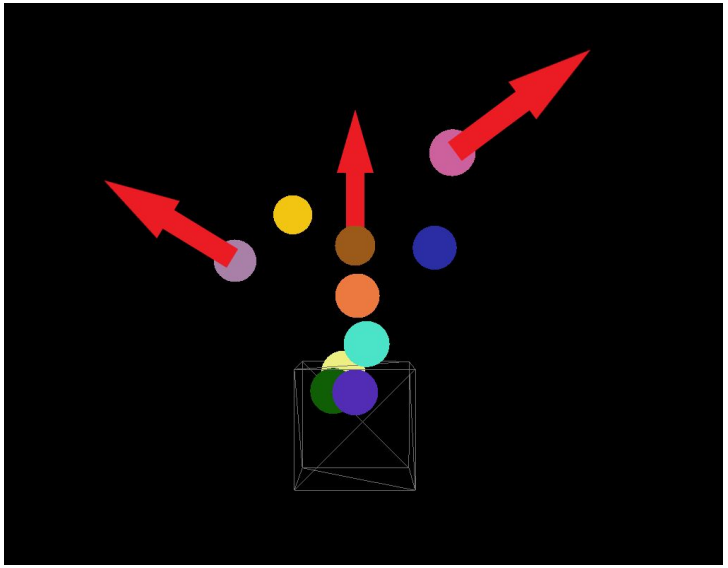
Emission

Generation of new particles

- Spawning Rate: How many new particles generate per unit of time
- Emitter: Where particles spawn
- Initial Velocity



Simulation

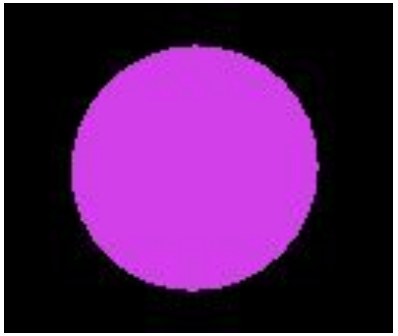


Update particles' positions over time

- Can be as simple as a translation
- Can be based off mathematical model
  - Simple example uses s = vt
    - s is the displacement, v is velocity, t is time
  - Can also have acceleration

Particle Lifetime

Rendering



Display the particles

Often represented as 2D billboarded objects

- Face is always towards the camera

In certain situations, simple 3D models can be used

Can be computationally taxing to render and update many particles

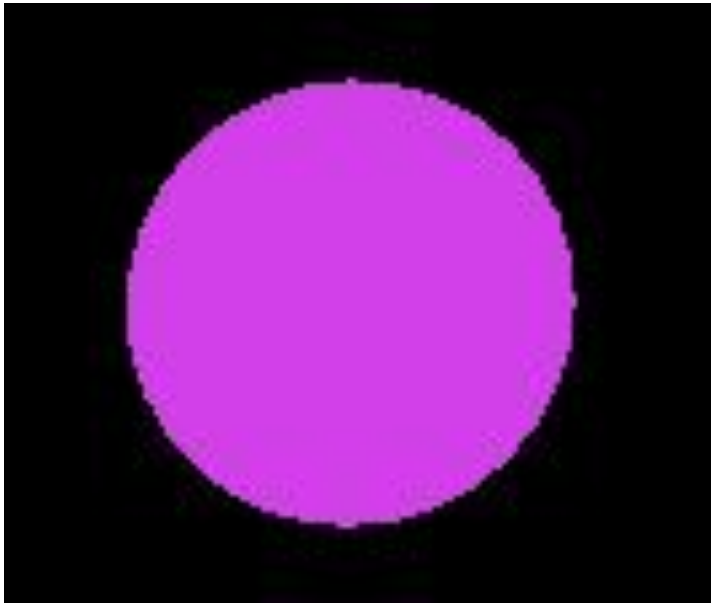
Implementing a Particle System

Particle Class

Each instance of class represents single particle

Five fields:

- Position - Vector3
- Velocity - Vector3
- Color - Color
- Life - Float
- Mesh



Mesh

Need to associate parameters with a Three.js object

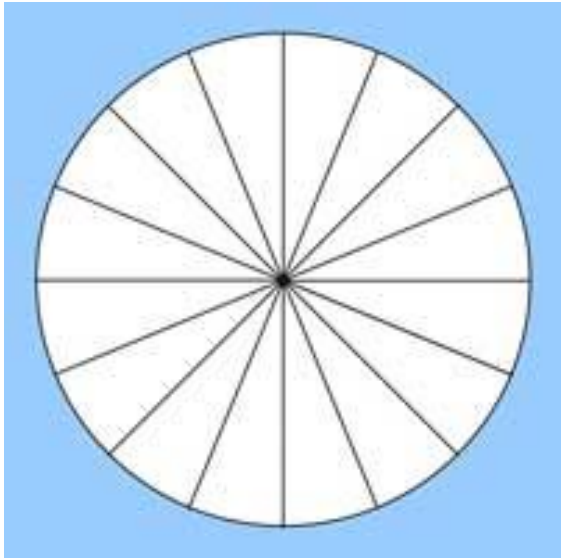
Give reference to a mesh that is placed in the scene

Uses Three.js circle geometry

- Takes position and radius

Use lookAt method to achieve billboarding

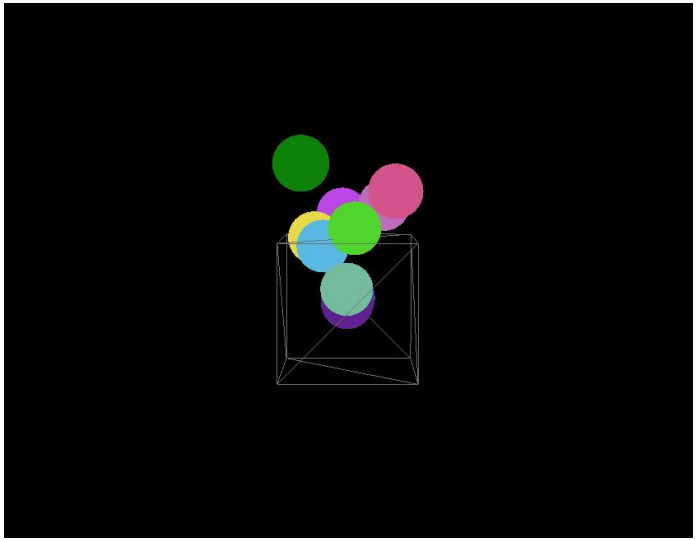
- Faces positive z by default



Spawning

Creates new particle object

- Sets life to zero, position to the spawning origin, and velocity to random value within a range
- Creates new circle geometry and mesh
- Adds mesh to scene
- Adds particle to particle array



Updating

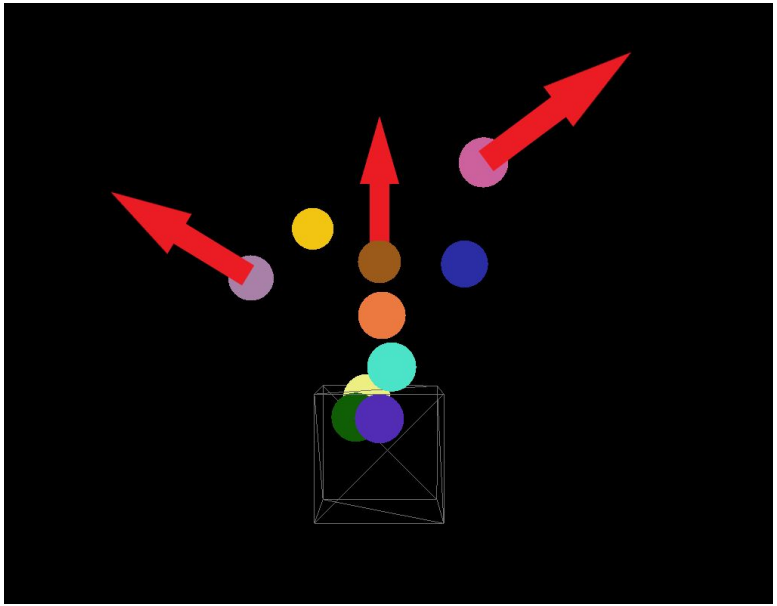
Additional method added to draw loop

Checks maximum number of particles

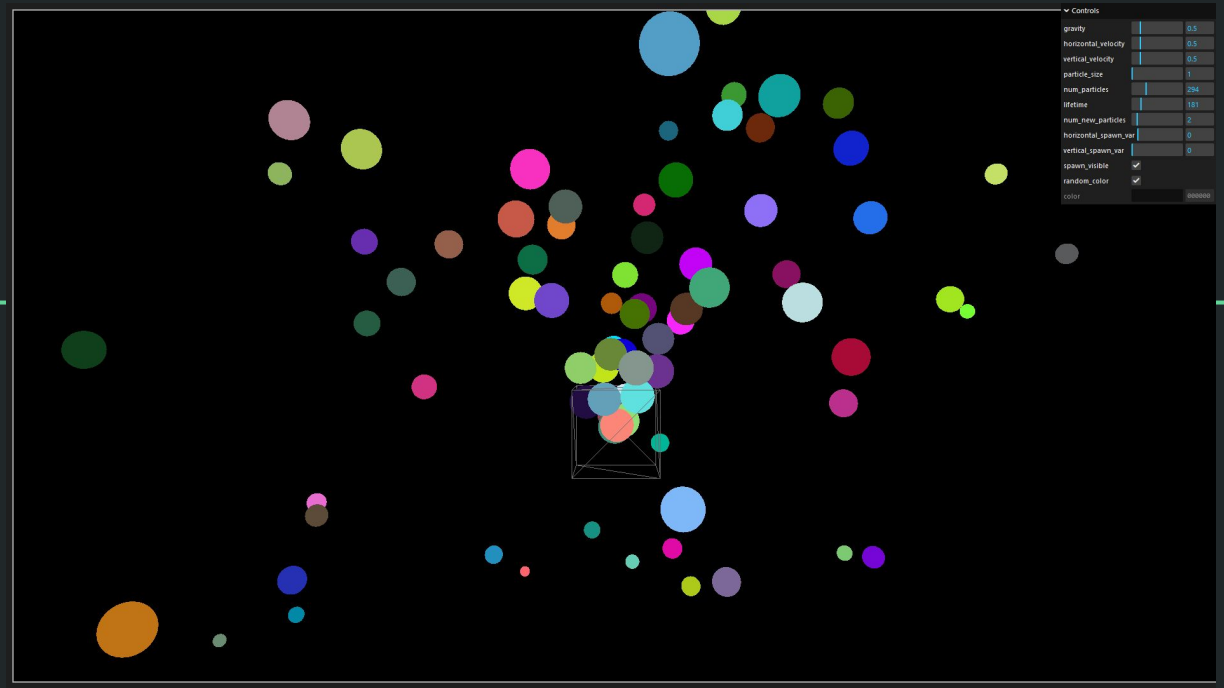
- If not, spawns new particles based on spawn rate

Checks each particle’s life value

- If greater than lifetime:
  - Deletes mesh from scene
  - Deletes particle from array
- Otherwise:
  - Set new position using motion equation
  - Updates particle’s velocity based on gravity



Questions?


Controls
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lifetime
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spawn_visible
random_color
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