Material Point Methods on WebGPU (Milestone 2)

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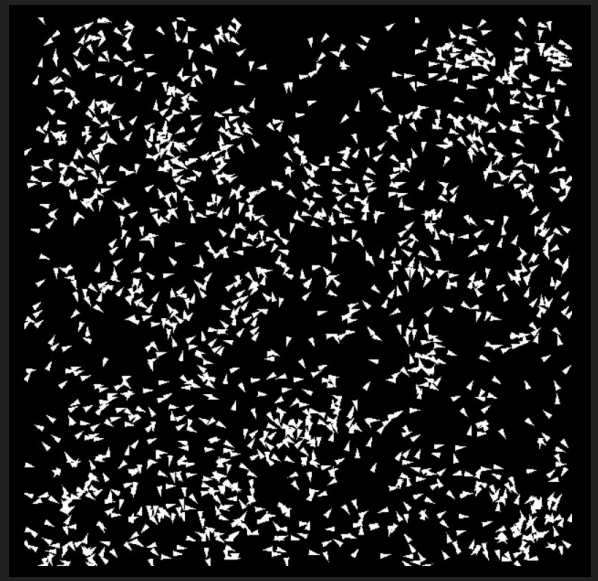
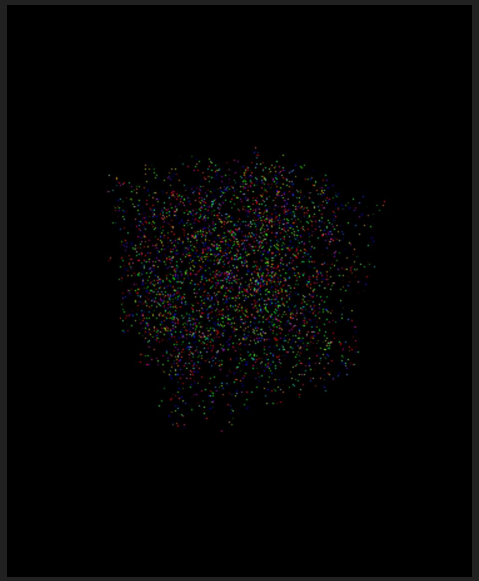
Our previous milestone

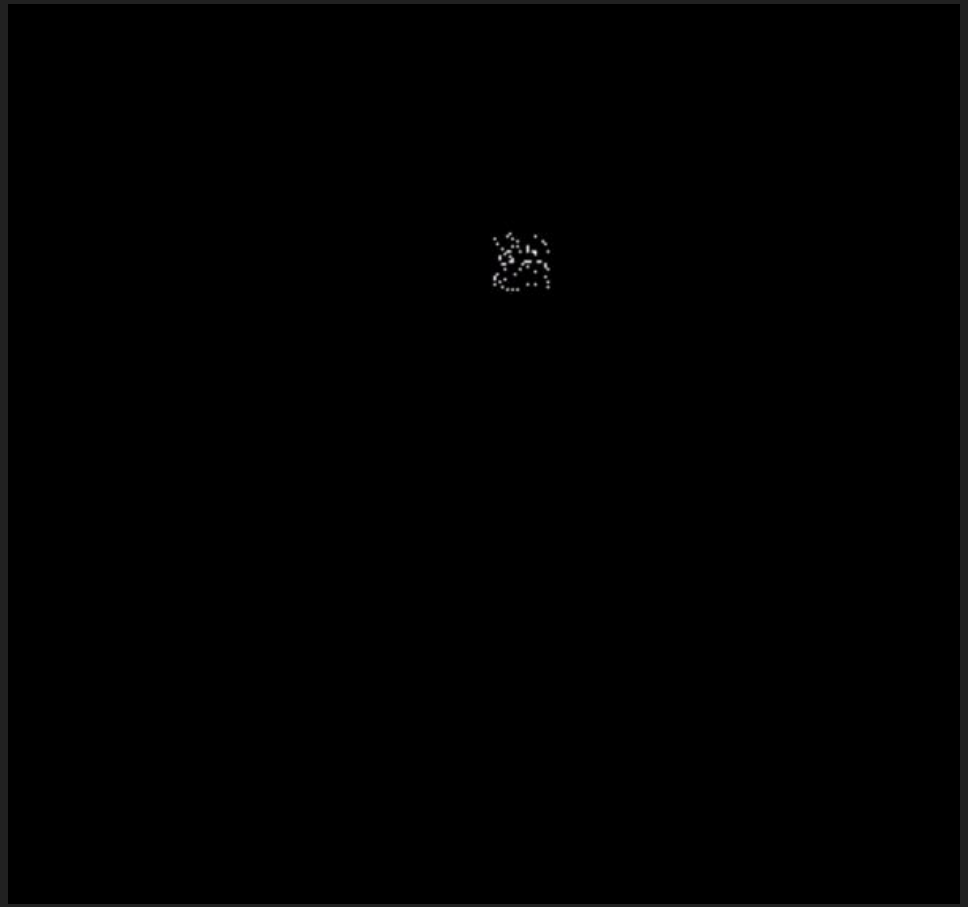
- Reviewed the MPM algorithm
- Familiarized with WebGPU
- Setup a simple codebase to visualize particles in 3D



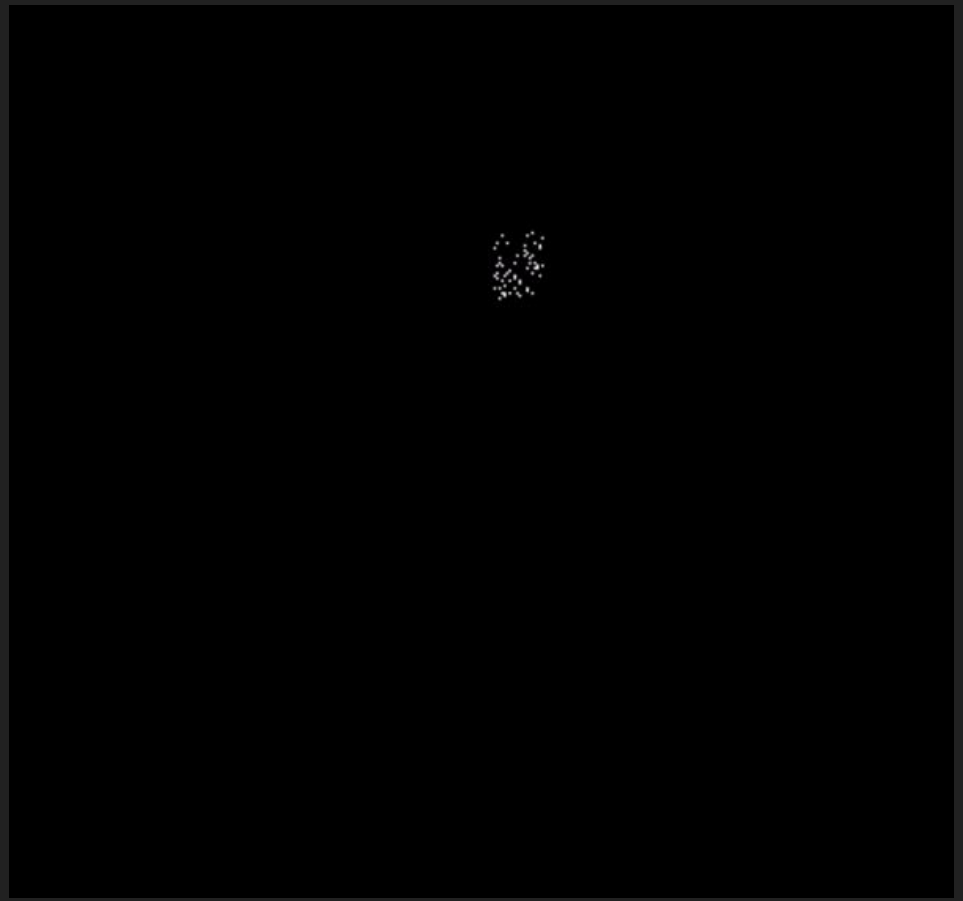


Milestone Results and Bloopers

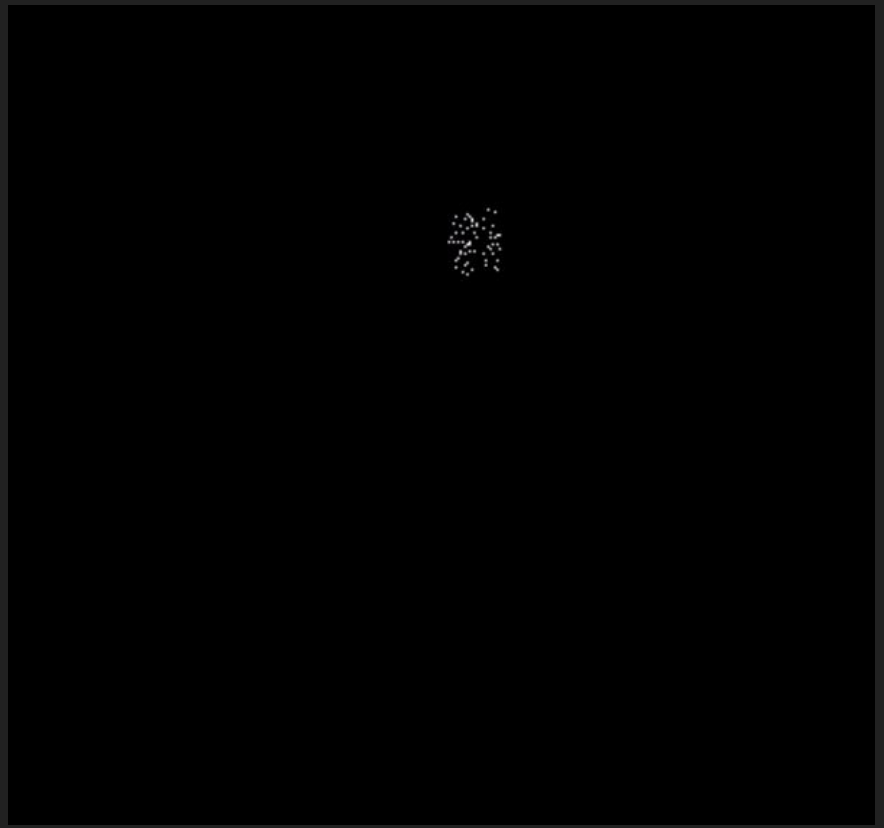
Fluid Simulation



Jello Simulation



Snow Simulation (Blooper)



Other accomplishments this milestone

1. Heavily refactored the codebase from milestone 1 to reduce boilerplate and improve maintainability

2. Reviewed literature to find options for parallel sorting algorithms on the GPU

Current and Next Milestone

- **Milestone 2**
  - Complete naively parallelized MPM (achieved)
  - Verify simulation qualitatively (mostly achieved)

- **Milestone 3**
  - Optimize MPM data transfer between particle and grid
  - Combine shaders where possible to get more compute per data access
  - Setup infrastructure for benchmarking different implementations

Interesting Learnings and Musings

- OpenGL standard memory layouts can be quite confusing to deal with (e.g. std140 or std430)

- Interleaved vs non-interleaved buffers

- The “lowest common denominator” curse of platform agnostic frameworks is very real :(