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Project #7A OpenCL / OpenGL Particle System

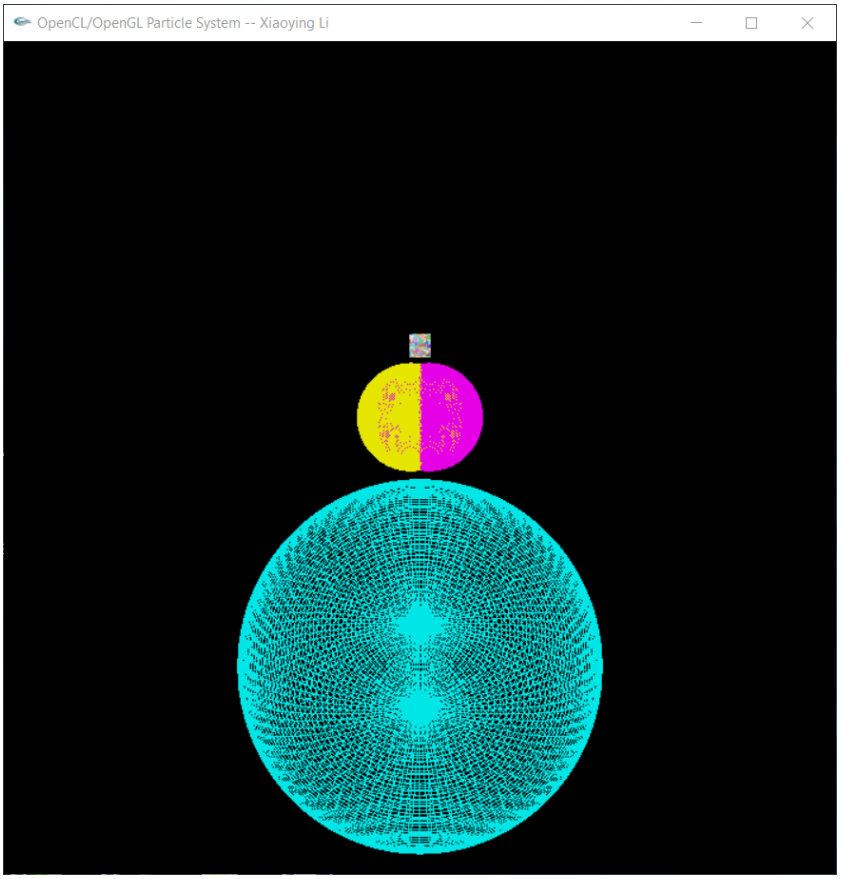
- **Web link to the video showing my program in action:**
  https://media.oregonstate.edu/media/t/0_xrdbzzlv/

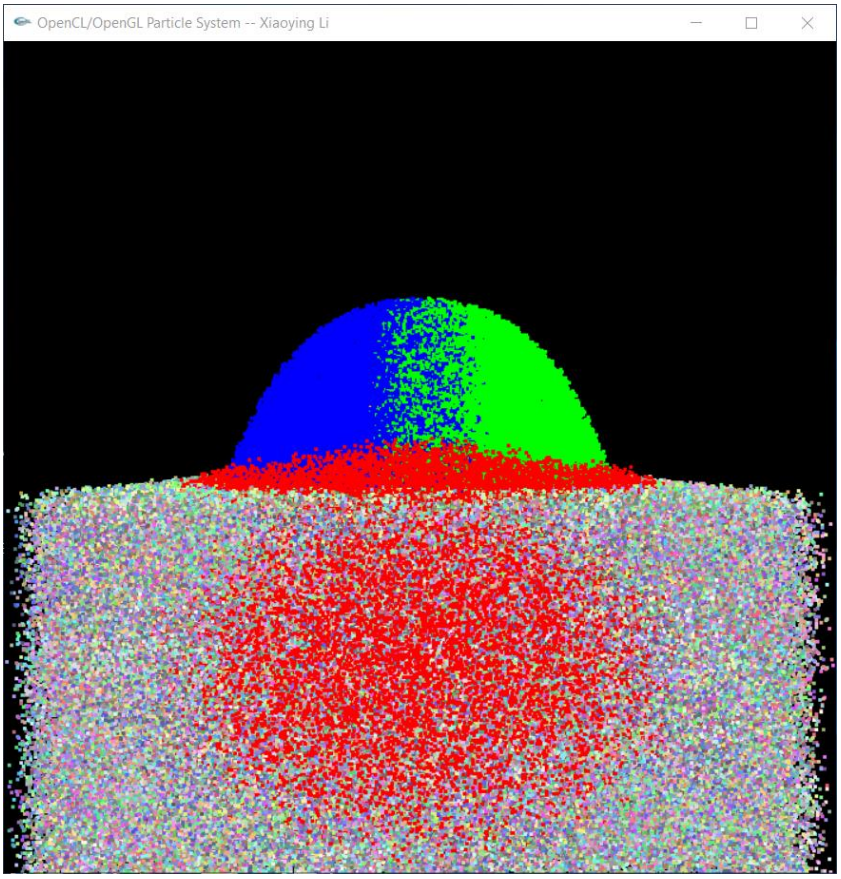
- **Machine:**
  Processor: Intel® Core™ i5-4210H CPU @ 2.90GHz 2.90 GHz
  Installed RAM: 16.0 GB
  System type: 64-bit operating system, x64-based processor
  OS Edition: Windows 10 Education
  GPU: NVDIA GeForce GTX 850M

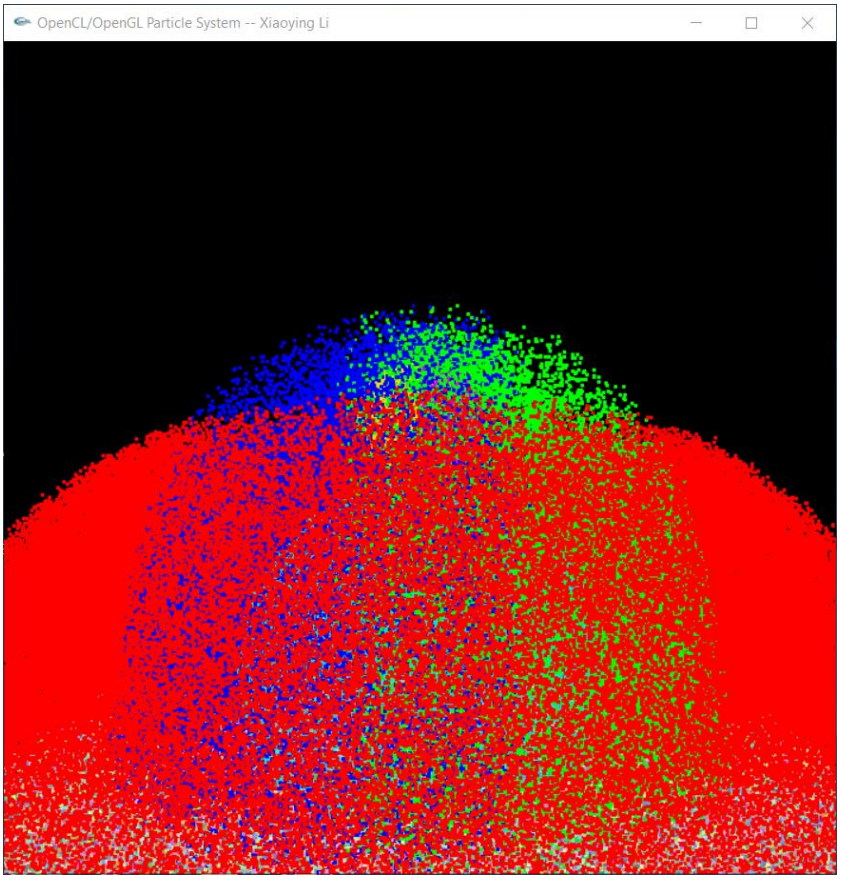
- **Predictable dynamic thing I did with the particle colors:**

The particle's color will change to blue if it hits the yellow bumper (Sphere1). The particle's color will change to green if it hits the pink bumper (Sphere2). And the particle's color will change to red if it hits the blue bumper (Sphere3).

- **Screen capture images of my project in action:**



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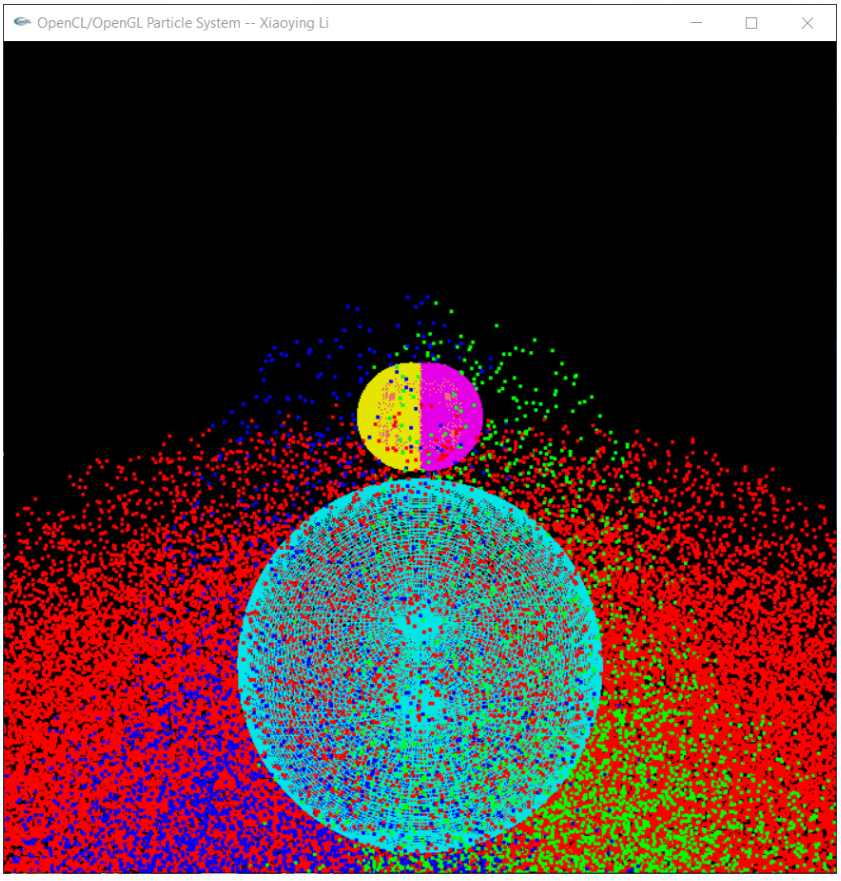
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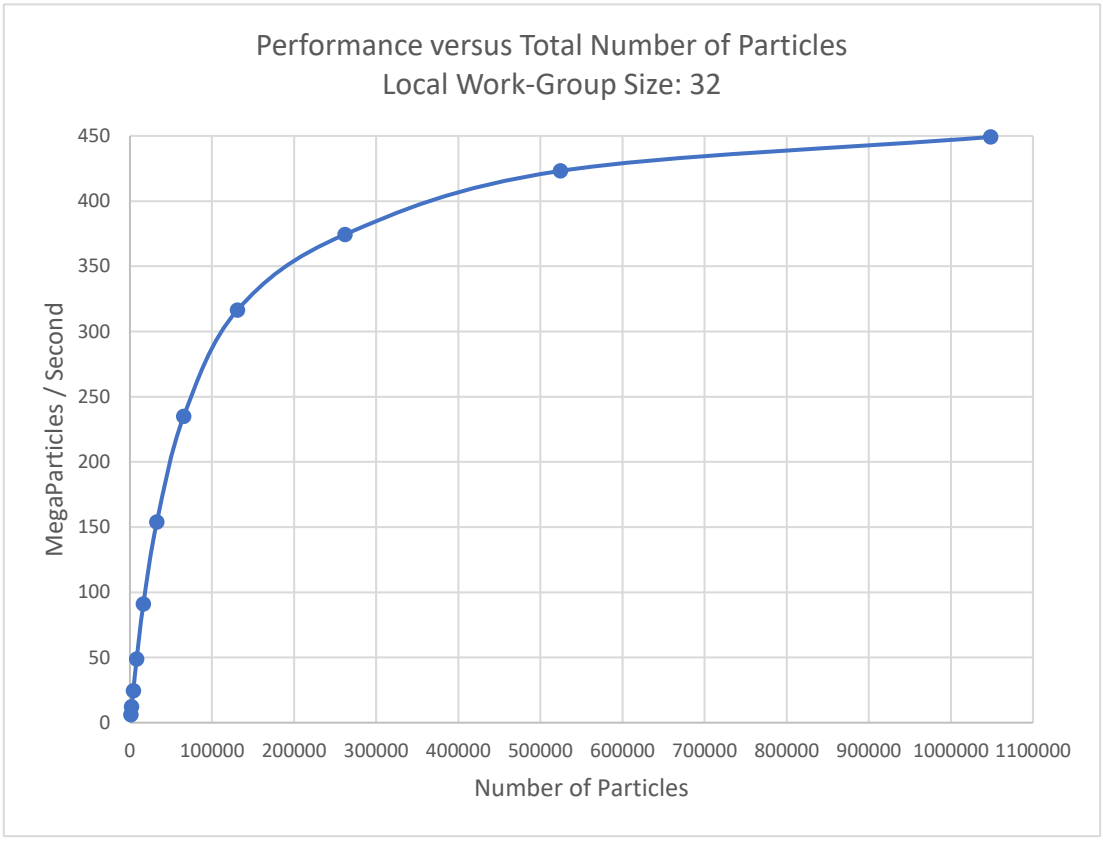
NOTE:

The performance values I listed below in the table and graph are the peak performance under each number of particles. I let the program capture the max performance value in the run loop, and output it to console when the button 'Quit' is hit.

- **Table of Performance versus Total Number of Particles (Local Group-Work Size: 32):**

Total Number of Particles	Performance (MegaParticles/Second)
1024	6.16
2048	12.16
4096	24.62
8192	48.83
16384	91.13
32768	153.81
65536	234.99
131072	316.53
262144	374.46
524288	423.13
1048576	449.17

- **Graph of Performance versus Total Number of Particles:**



- **Patterns in the performance curve and why:**

The performance increases as the total number of particles increases. But the velocity of the performance's increase decreases as the total number of particles increases.

I think the reason is that larger number of particles means larger global dataset size. And larger global dataset size means larger amounts of data parallelism, which can make better use of the computing power of GPU. So, the performance increases as the total number of particles increases.

But larger global dataset size also means larger overhead cost from OpenCL / OpenGL. As the global dataset size increases, more speed increases gained from OpenGL / OpenCL are cut down by the overhead cost. So, the velocity of the performance's increase decreases as the total number of particles increases.

- **Meaning for the proper use of GPU parallel computing:**

When using OpenCL / OpenGL to do GPU parallel computing, it's at its best on compute devices with large amounts of data parallelism. Therefore, larger global data size can make better use of GPU's computing power, and bring better performance.