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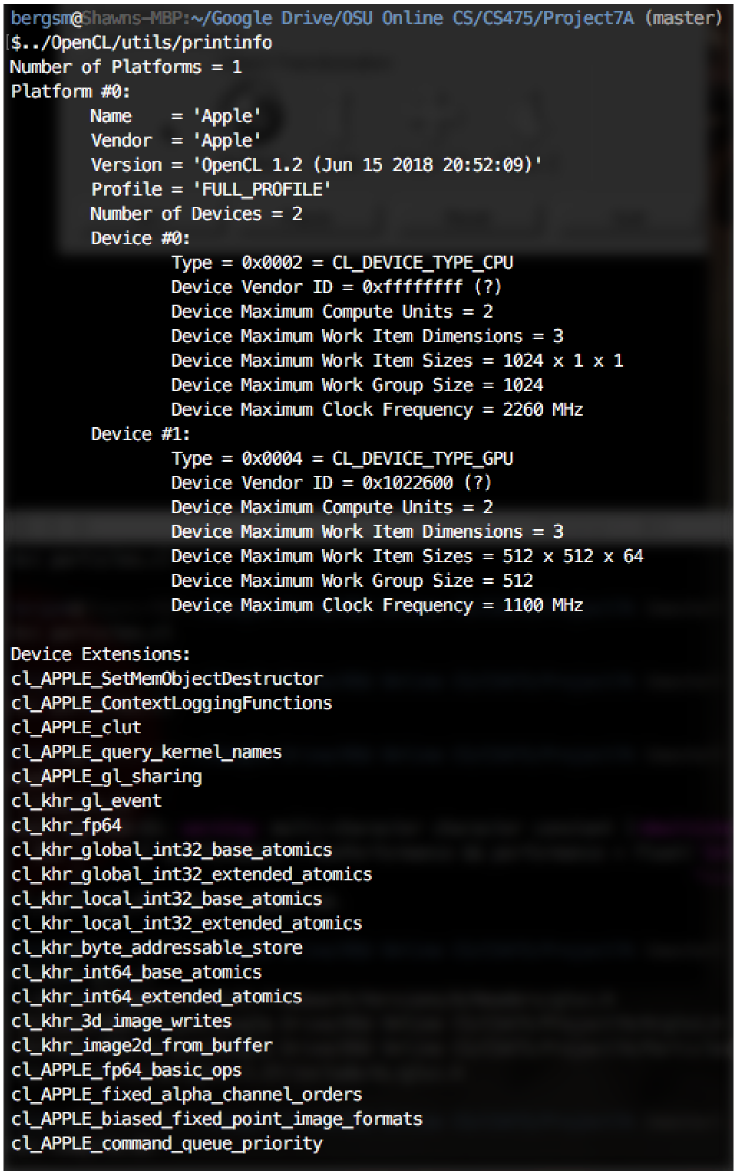
CS 475

Project 7A
OpenCL / OpenGL Particle System

Video Demo: https://media.oregonstate.edu/media/t/1_64fer0ca

Machine:

This project was run on a 2009 Macbook Pro laptop. The details of this machine are below:



```
bergsm@Shawns-MBP:~/Google Drive/OSU Online CS/CS475/Project7A (master)
[$../OpenCL/utils/printinfo
Number of Platforms = 1
Platform #0:
        Name    = 'Apple'
        Vendor  = 'Apple'
        Version = 'OpenCL 1.2 (Jun 15 2018 20:52:09)'
        Profile = 'FULL_PROFILE'
        Number of Devices = 2
        Device #0:
                Type = 0x0002 = CL_DEVICE_TYPE_CPU
                Device Vendor ID = 0xffffffff (?)
                Device Maximum Compute Units = 2
                Device Maximum Work Item Dimensions = 3
                Device Maximum Work Item Sizes = 1024 x 1 x 1
                Device Maximum Work Group Size = 1024
                Device Maximum Clock Frequency = 2260 MHz
        Device #1:
                Type = 0x0004 = CL_DEVICE_TYPE_GPU
                Device Vendor ID = 0x1022600 (?)
                Device Maximum Compute Units = 2
                Device Maximum Work Item Dimensions = 3
                Device Maximum Work Item Sizes = 512 x 512 x 64
                Device Maximum Work Group Size = 512
                Device Maximum Clock Frequency = 1100 MHz

Device Extensions:
cl_APPLE_SetMemObjectDestructor
cl_APPLE_ContextLoggingFunctions
cl_APPLE_clut
cl_APPLE_query_kernel_names
cl_APPLE_gl_sharing
cl_khr_gl_event
cl_khr_fp64
cl_khr_global_int32_base_atomics
cl_khr_global_int32_extended_atomics
cl_khr_local_int32_base_atomics
cl_khr_local_int32_extended_atomics
cl_khr_byte_addressable_store
cl_khr_int64_base_atomics
cl_khr_int64_extended_atomics
cl_khr_3d_image_writes
cl_khr_image2d_from_buffer
cl_APPLE_fp64_basic_ops
cl_APPLE_fixed_alpha_channel_orders
cl_APPLE_biased_fixed_point_image_formats
cl_APPLE_command_queue_priority
```

Dynamic Color Change: Particle starts as gray and changes to color of sphere. If it hits both spheres it changes to the combined color of both spheres.

Screenshot:

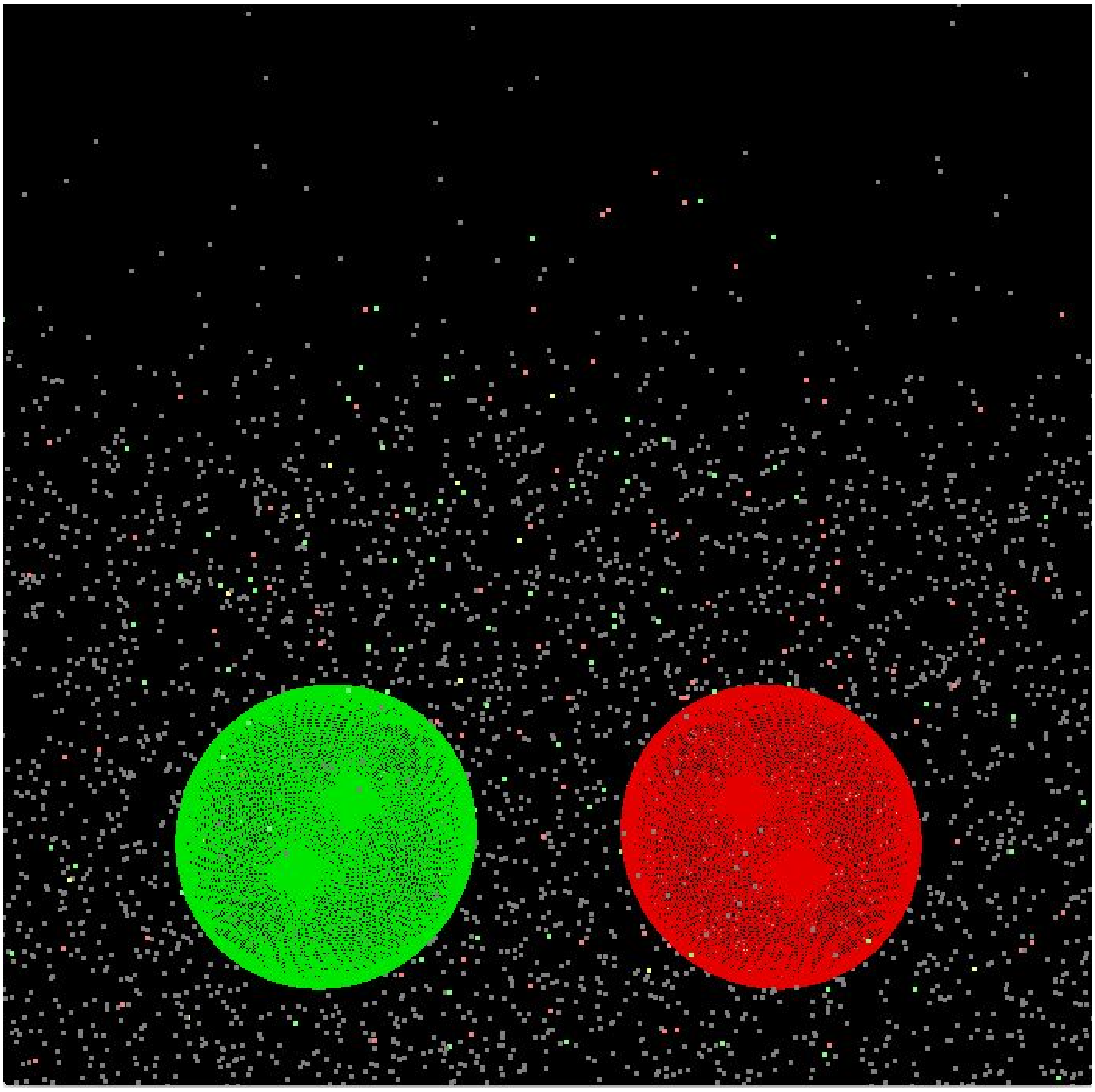
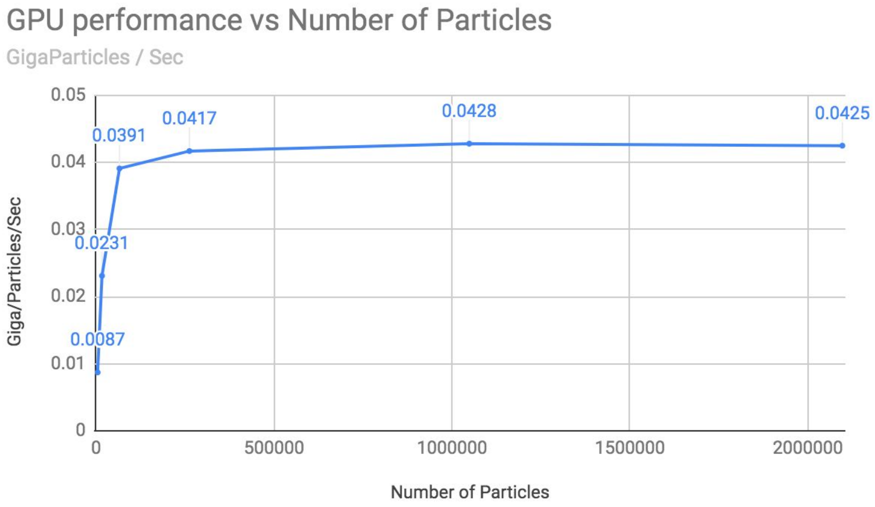


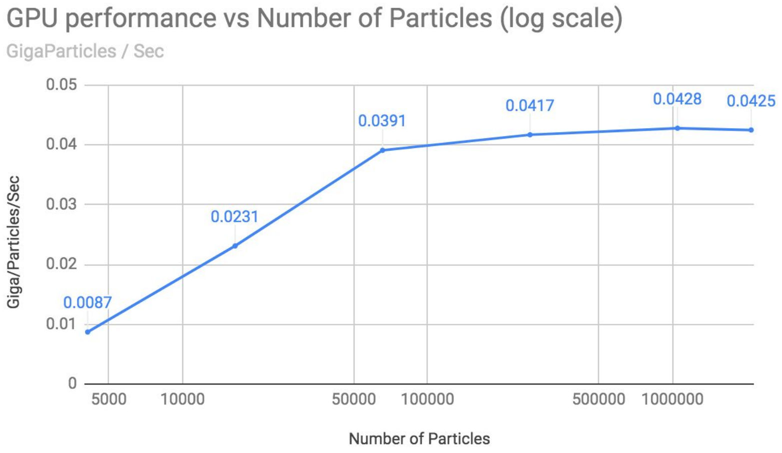
Table 1 (Performance as a function of Particles)

1024	0.0025
4096	0.0087
16384	0.0231
65536	0.0391
262144	0.0417
1048576	0.0428
2097152	0.0425

Graph 1 (Performance as a function of particles)



Graph 2 (Performance as a function of particles log scale)



Commentary

1. What patterns are you seeing in the performance curves?

   In the performance curve, there is an increase in performance with an increase in the number of particles and then a leveling off at just over ~1,000,000 particles.

2. Why do you think the patterns look this way?

   The pattern looks this way because with smaller particle sizes, the GPU is not being fully utilized. Thus, the particles calculated per second is lower. As more particles are thrown into the simulation, the GPU workload increases, and more of the GPU can be utilized. Because of this, the performance also increases.

3. What does that mean for the proper use of GPU parallel computing?

   It shows that the proper use of GPU parallel computing is for very data intensive applications where you need to perform a large amount of calculations in parallel. It also means that to effectively utilize GPU parallel computing, one needs to have a large enough data size to take full advantage of the available processing power.