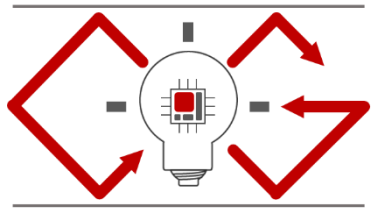
Programming Assignment 4

2021 Computer Graphics



Computer Graphics
Laboratory

G I S T
Computer Graphics
Laboratory

Submission

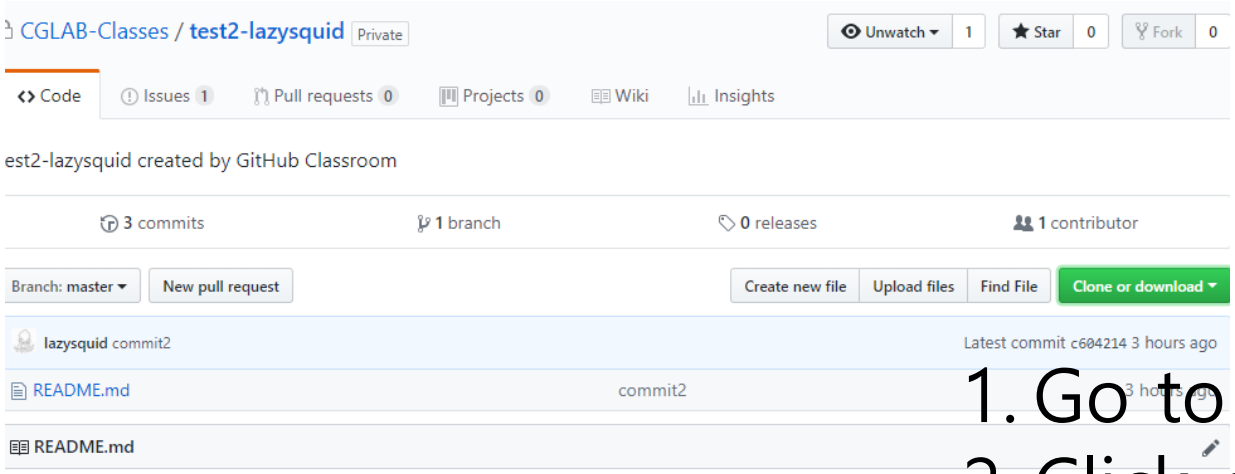
- Deadline: 23:59:59, Sunday, June 20th , 2021 (KST, +0900)
  - Github server clock

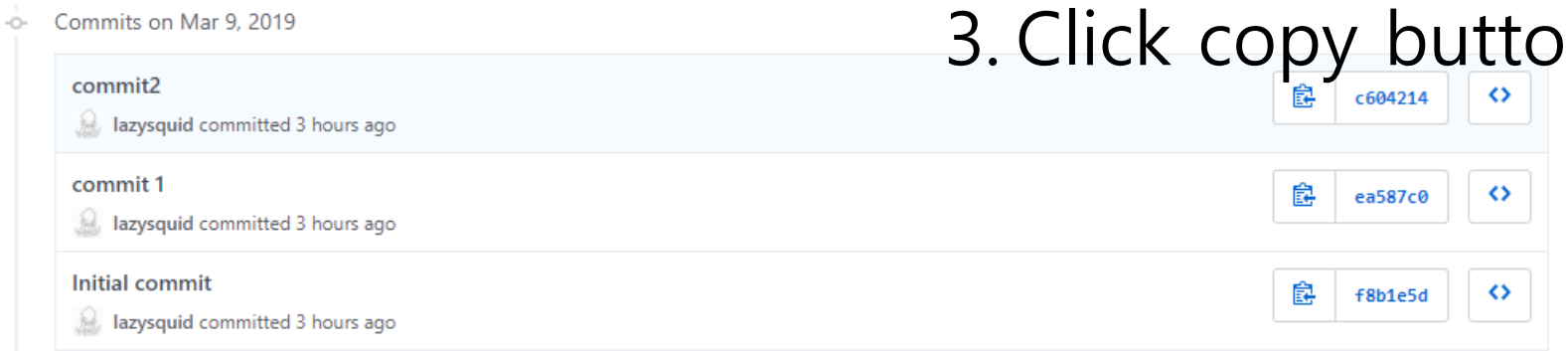
- To submit your assignment, you **must** do two things. **Both of them must be done BEFORE deadline.**

1. You should push your commit to your assignment repo before deadline.
   -Obviously, e- mail submission is not accepted
2. You should comment the last commit (before deadline) id (SHA-1 hash) in github issue board. (See next slide)

- The last commit BEFORE dead line will be considered as submitted assignment.
  - Github server will track this for me.
  - Timestamp in your commit (local time) will be igrnoed. (I will use github server timestamp instead)

Commenting Commit ID 1/2

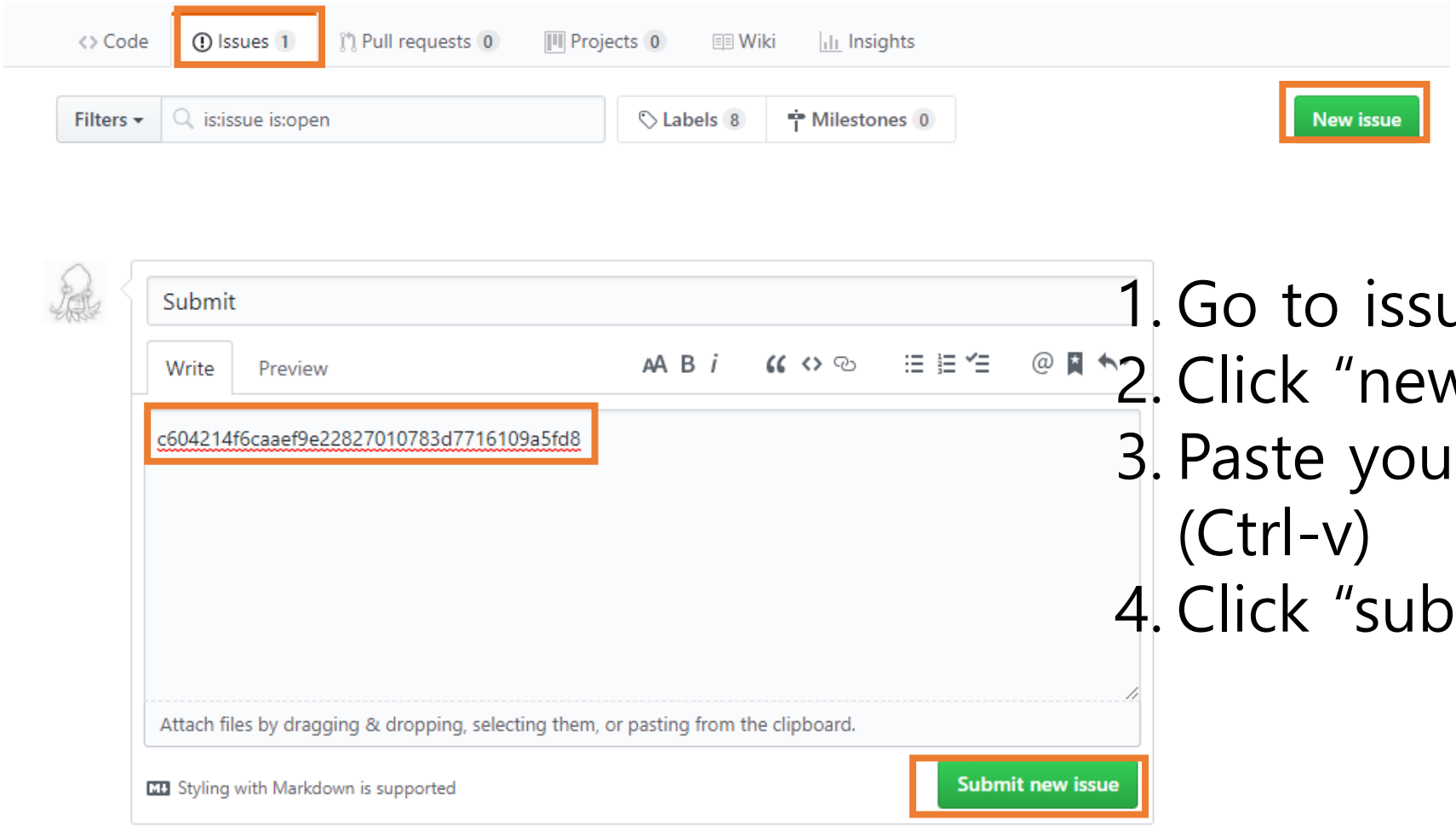




1. Go to your assignment repository
2. Click commits
3. Click copy button of your last commit

Computer Graphics Laboratory

Commenting Commit ID 2/2



1. Go to issue tab
2. Click “new issue”
3. Paste your lastest commit id (Ctrl-v)
4. Click “submit new isse”

Policy

- In the following cases, your grade for this PA will be 0
- Late submission (Late push before deadline or Late last commit id comment on issue board)
- Build/execution failure
- Making public of your assignment repository
- If you tried to push your commit with force option(Tried to change history of remote server)

- Your final grade will be “F”
- Copy

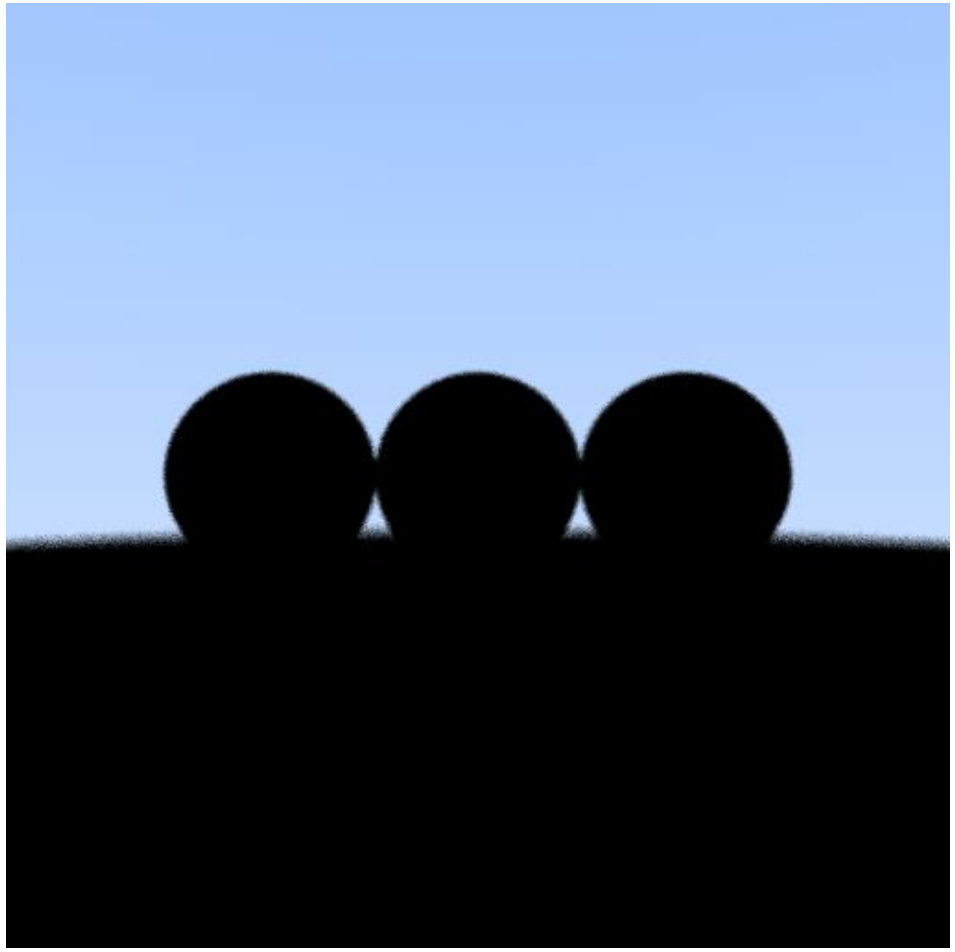
Task List

1. Materials (10 Points)
   - Lambertian, Metal, Dielectric, Area light(Emissive material)
   - Implement **scatter** function in each material class
2. Antialiasing (5 Points)
3. Indirect lighting (5 Points)
   - Multiple bounces, depth > 10
4. Direct light sampling (5 Points)
5. Defocus blur (5 Points)
6. Report (10 Points)
   - For this time, you need to write detailed report.
   - Add teaser image whenever you add new features(e.g. complete your task) and explain about it

Initial Appearance

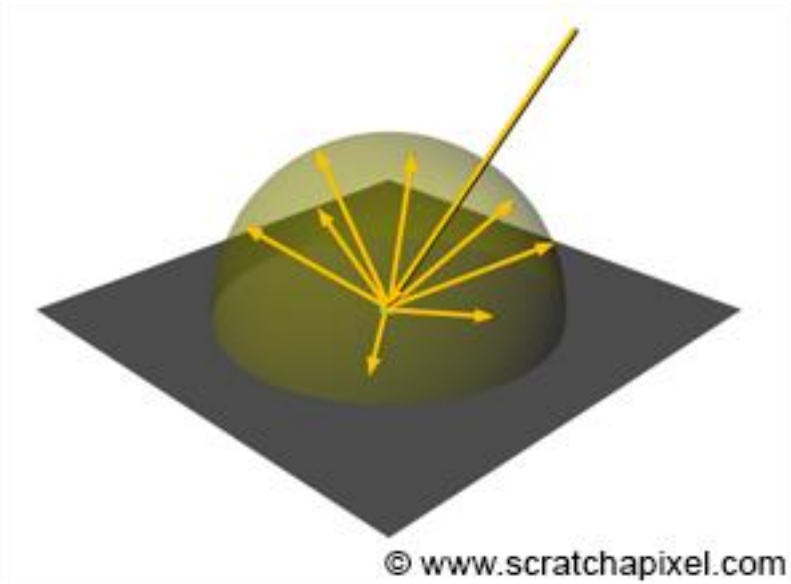
- Skeleton code: Neon renderer
- Unlike OpenGL project the result will be png file.

- output: *.png

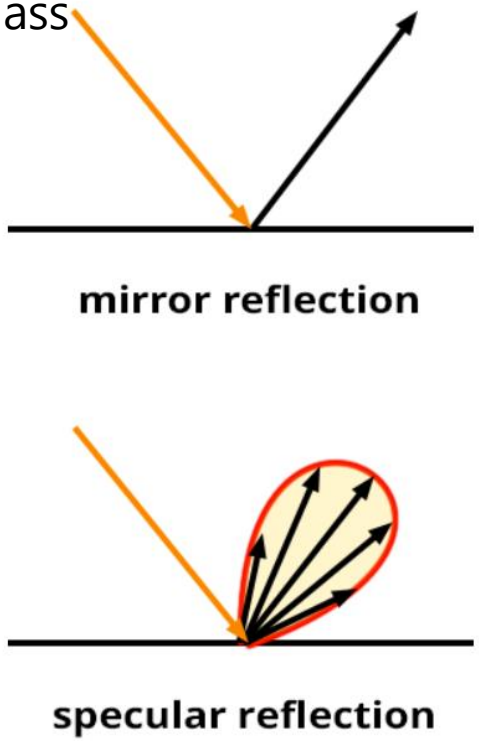


Materials

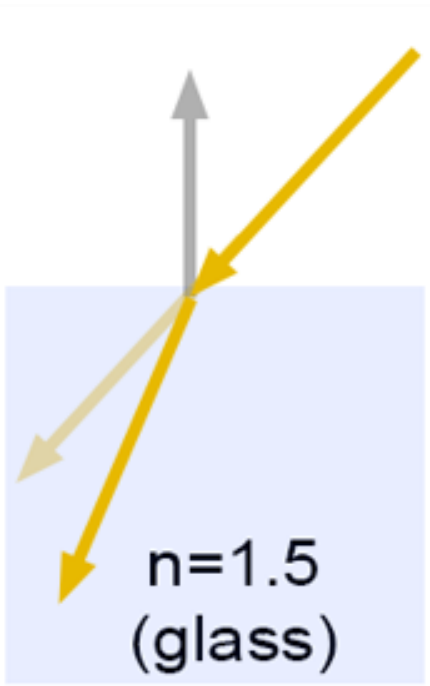
See **scatter** method in each material class



Lambertian (diffuse)



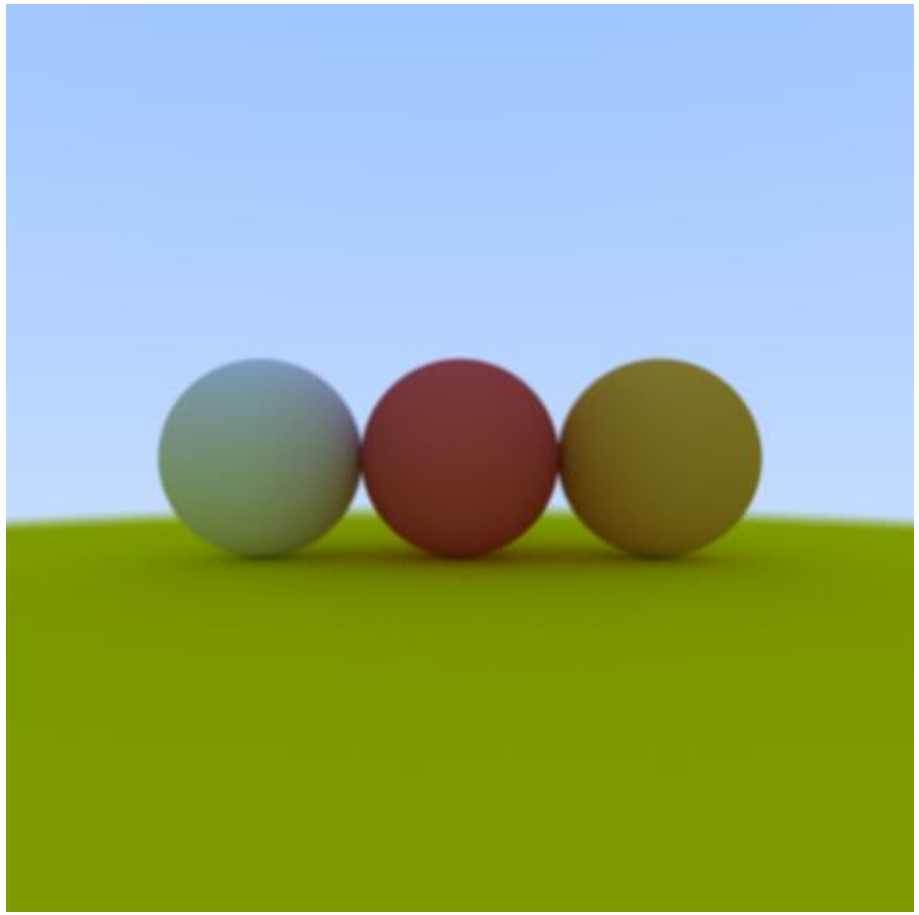
Metal(Mirror reflection with some randomness)



Dielectric

https://www.scratchapixel.com/lessons/3d-basic-rendering/introduction-to-shading

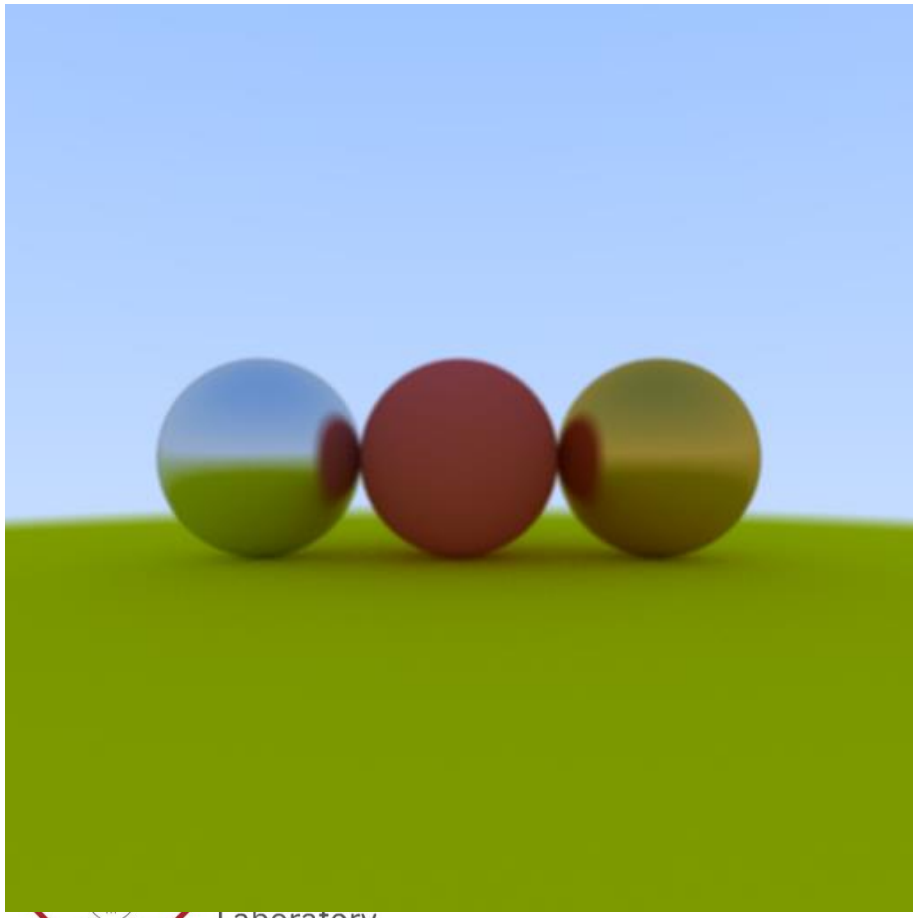
Materials

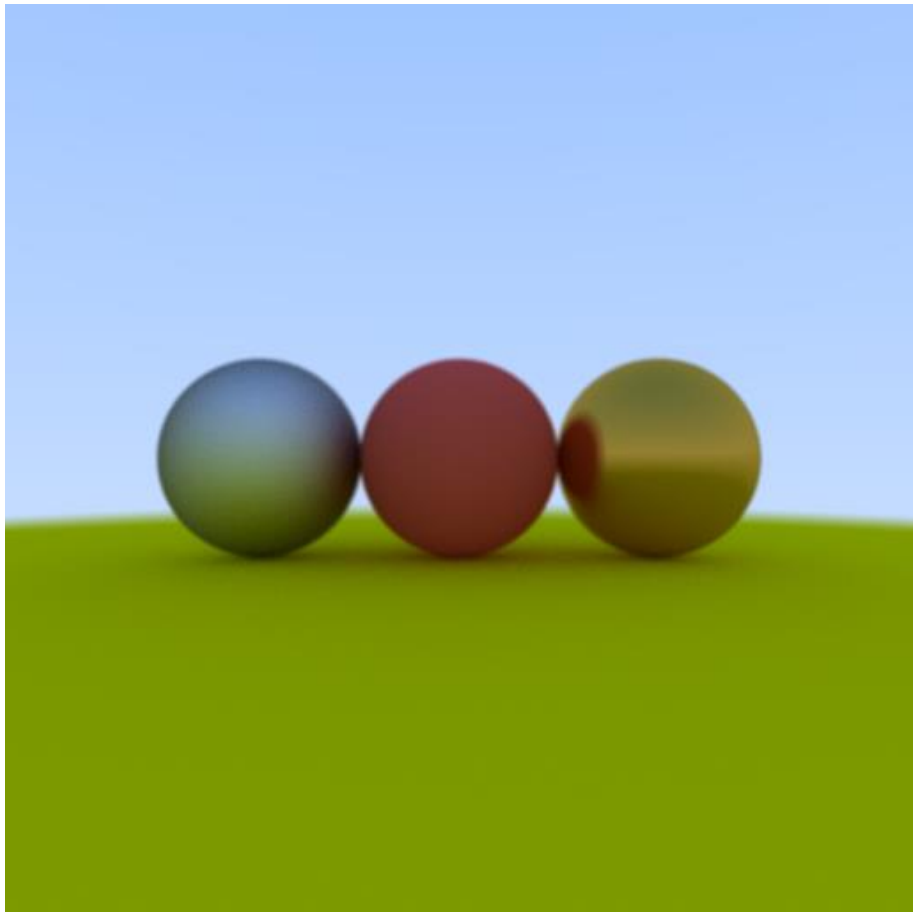


Lambertian

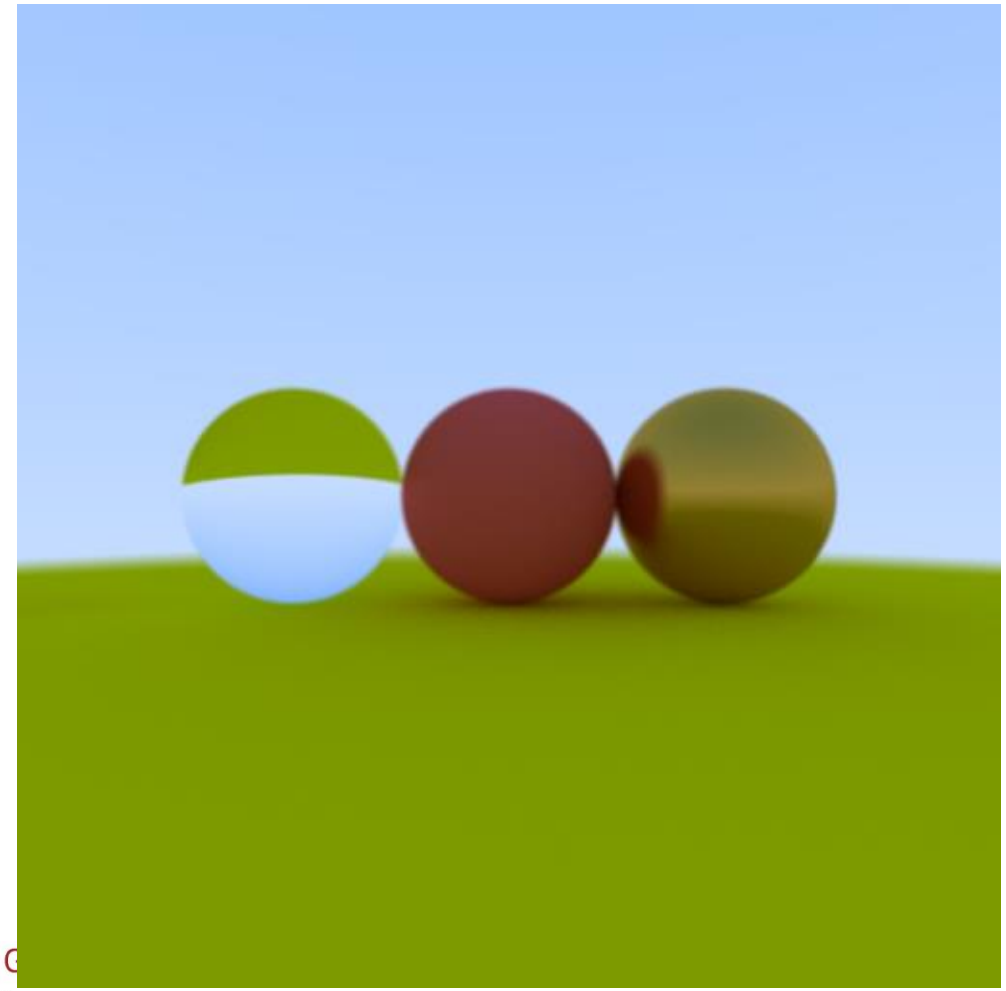
Materials

- Perfect mirror vs metal (mirror with randomness)





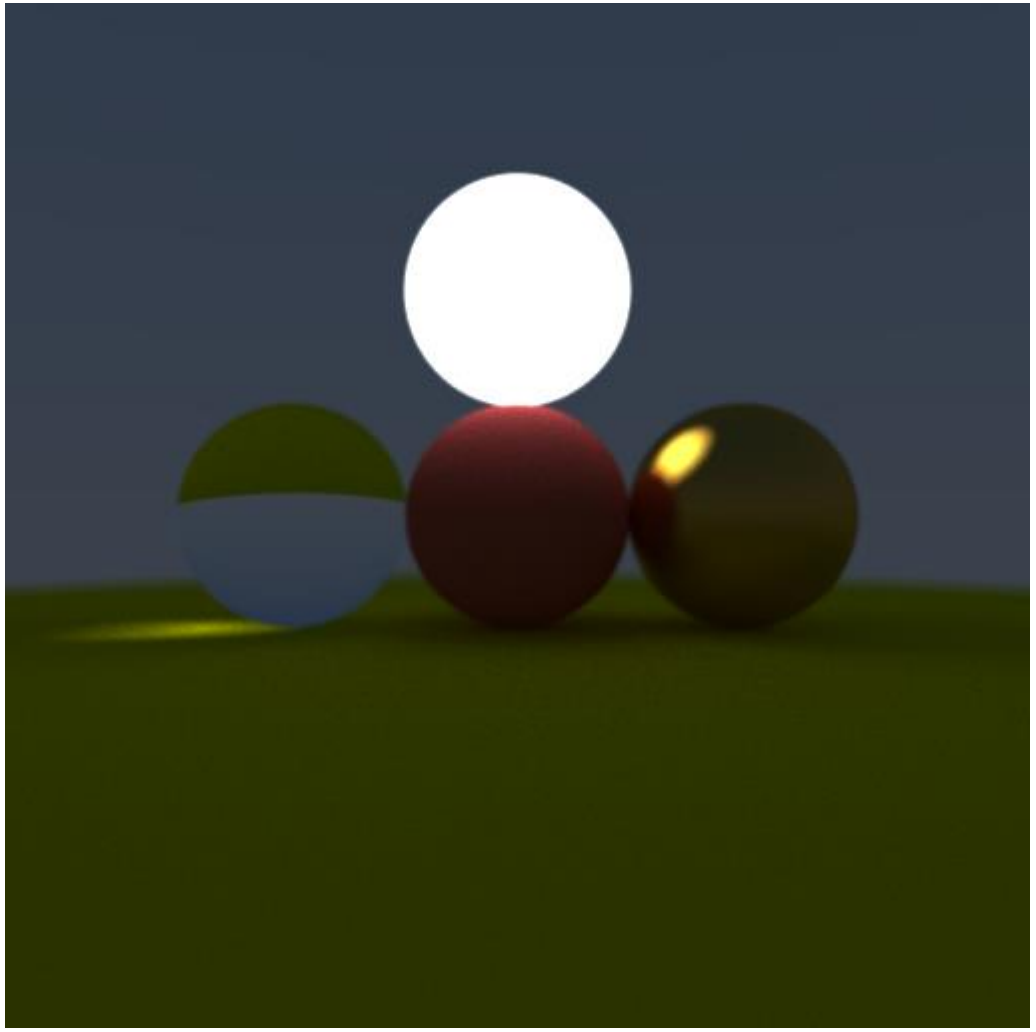
Materials



dielectric material

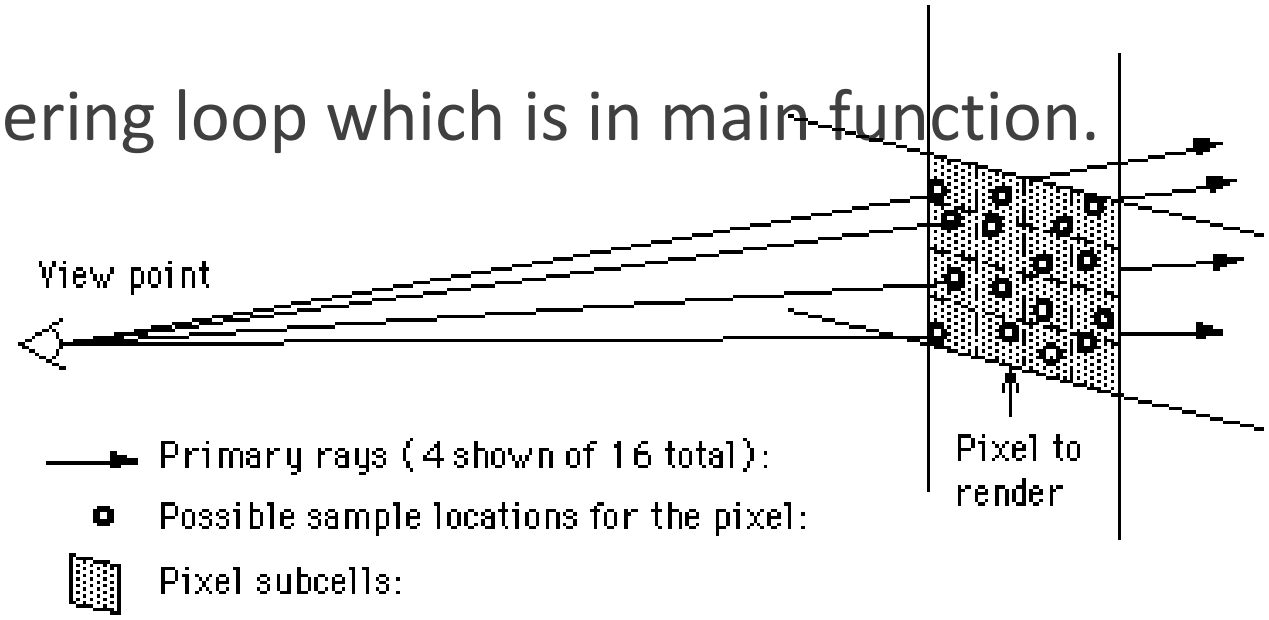
Materials

- Light ball
- Perfect glass ball
- Perfect diffuse ball
- Glossy metal



Antialiasing

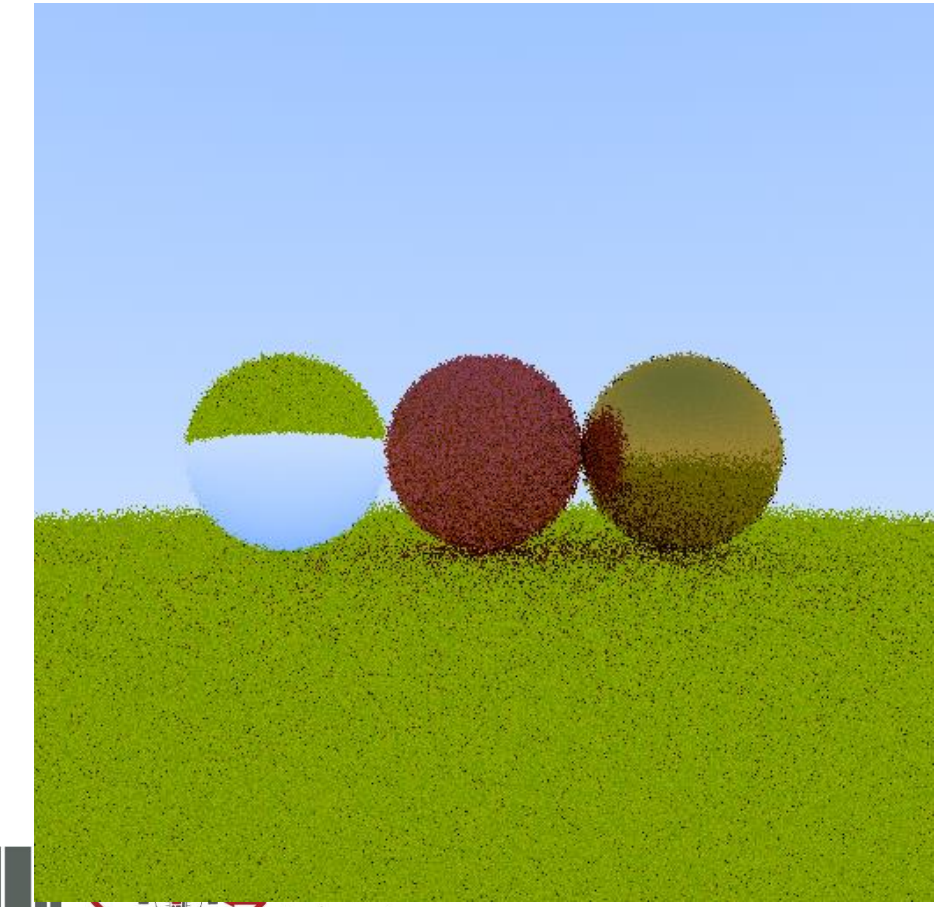
- Shoot multiple rays per pixel
- Final color will be average of those ray colors
- You can control this in rendering loop which is in main function.

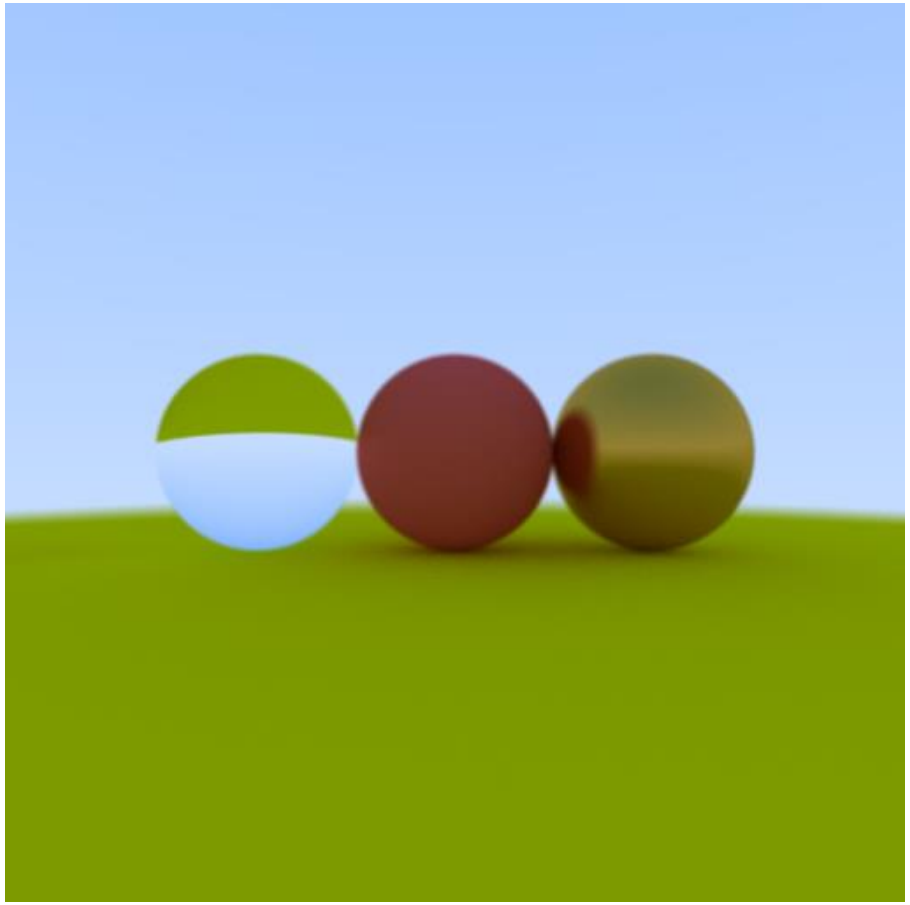


http://www.cs.montana.edu/~halla/cs525/intro.html

Antialiasing

- 1spp vs 1024 spp (samples per pixel)

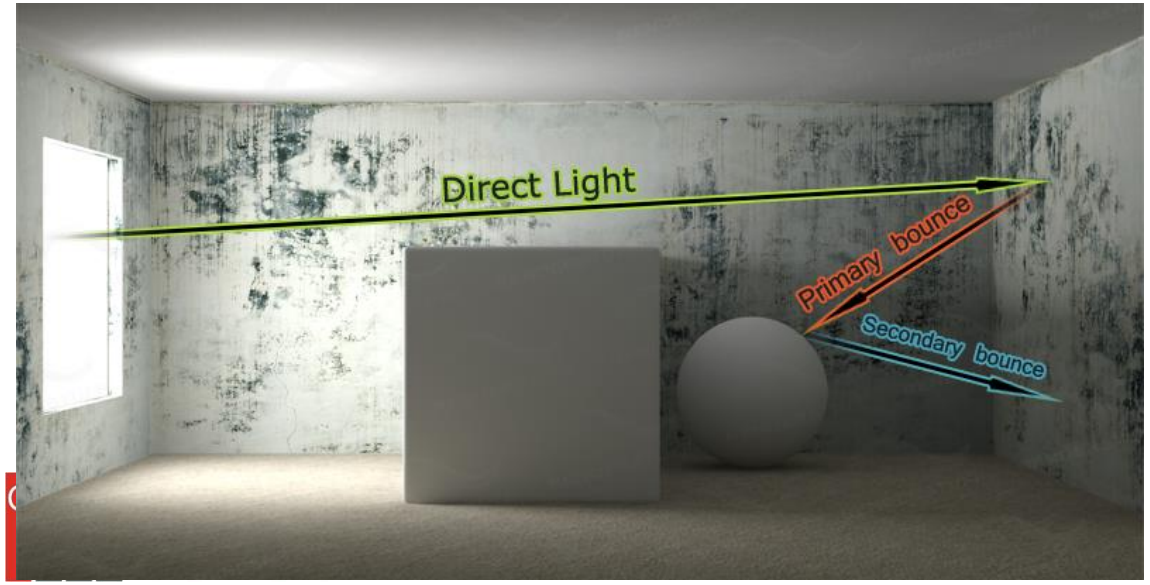


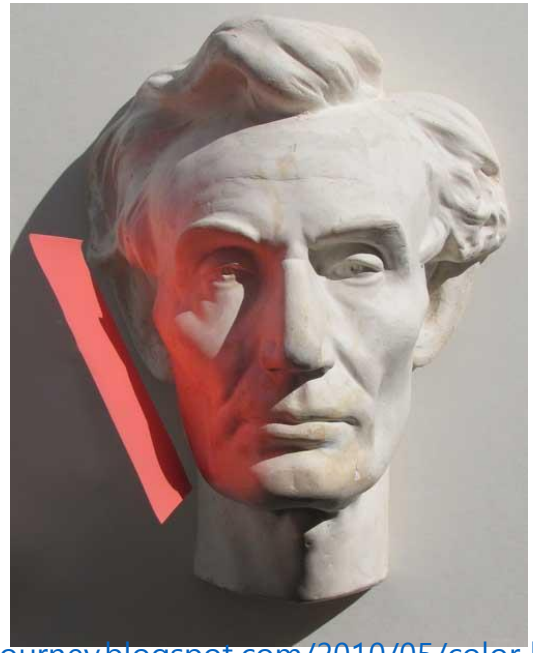


Indirect Lighting

- Simulate multiple bounce of light.
- You can see color bleeding(Diffusive interreflections) after this!
- See **integrate** method in **integrator** class to control this behavior

https://www.pinterest.co.kr/pin/362117626263103458/

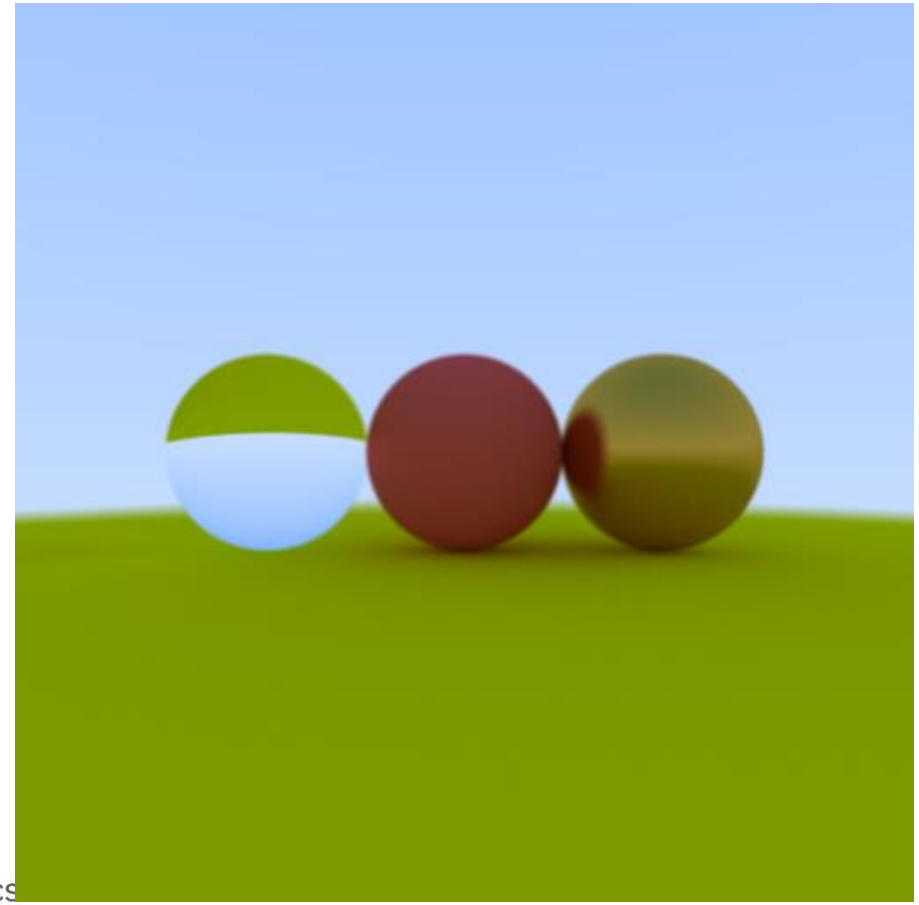




http://gurneyjourney.blogspot.com/2010/05/color-bleeding.html

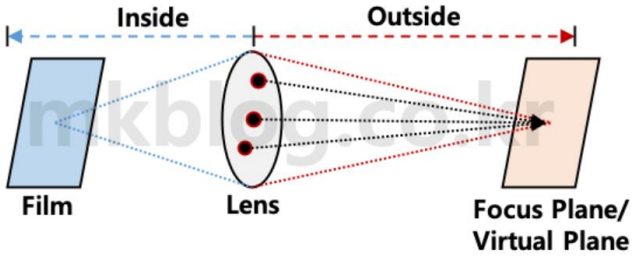
Indirect Lighting

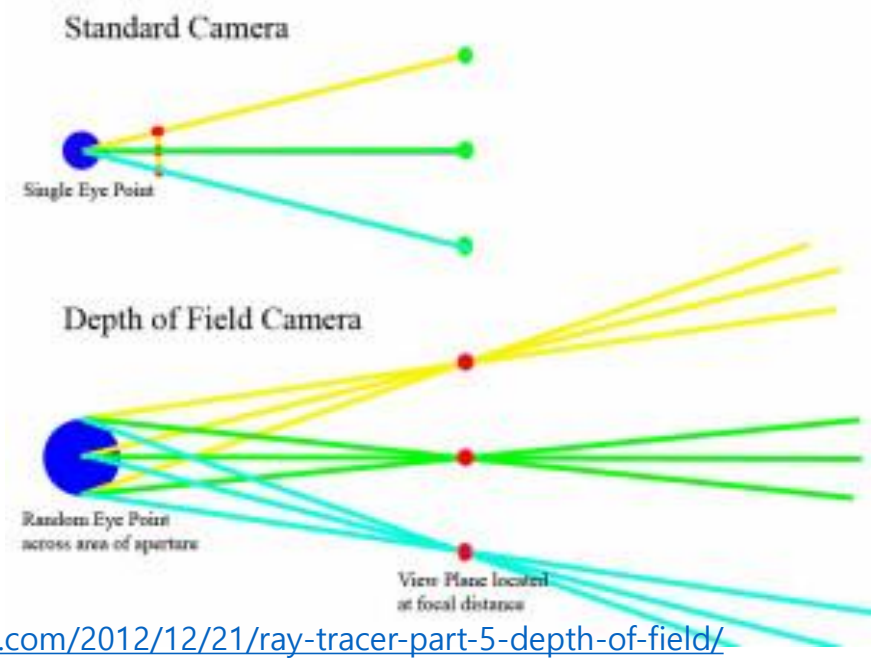
- See red color bleeding under the red sphere



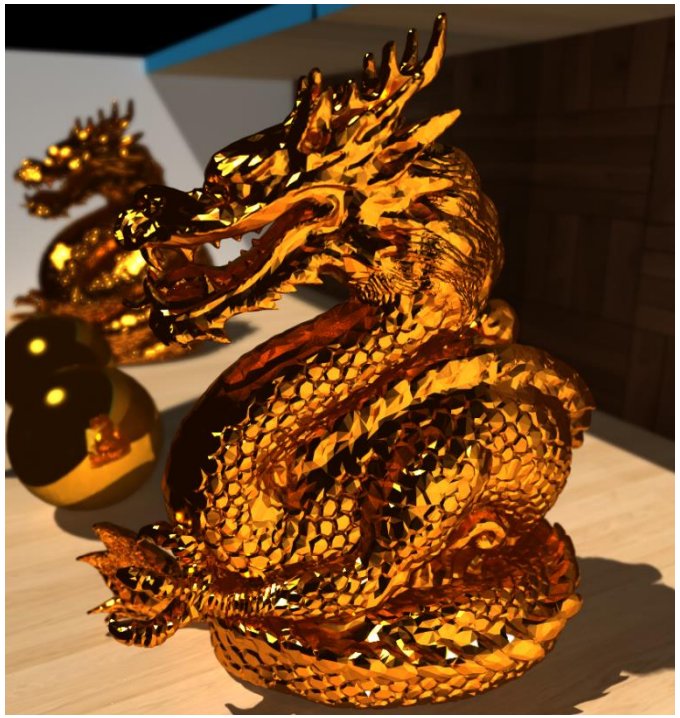
Defocus Blur

- A.K.A Out focusing == Simulating lens effect
- Generate random 2d point and add to ray origin.
- See **camera** class



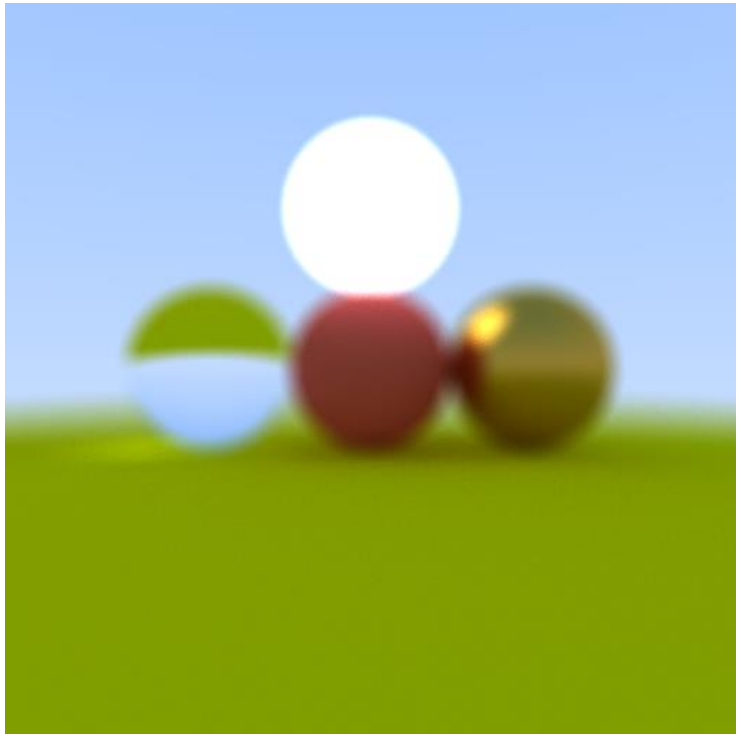


https://steveharveynz.wordpress.com/2012/12/21/ray-tracer-part-5-depth-of-field/

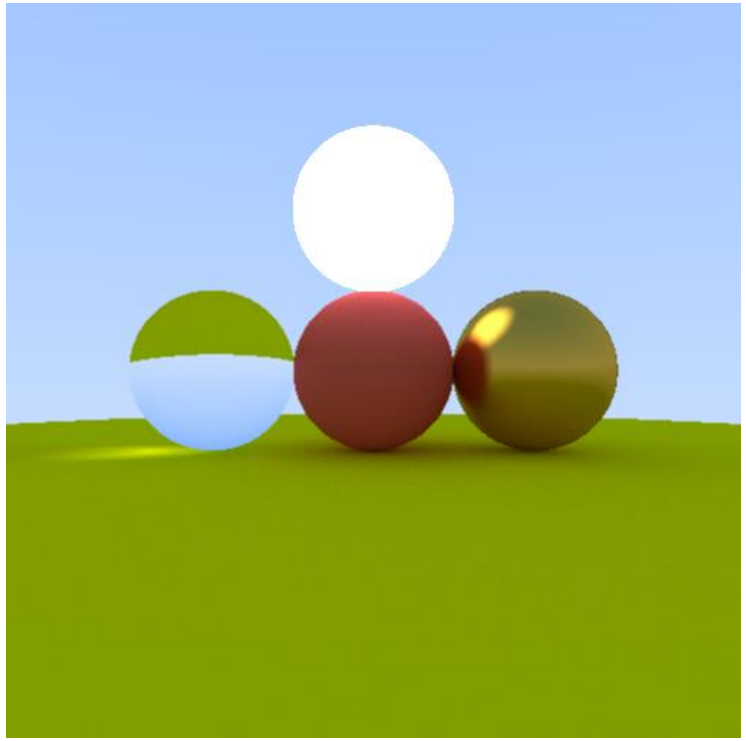


https://www.nebularender.com/gallery.html

Defocus Blur



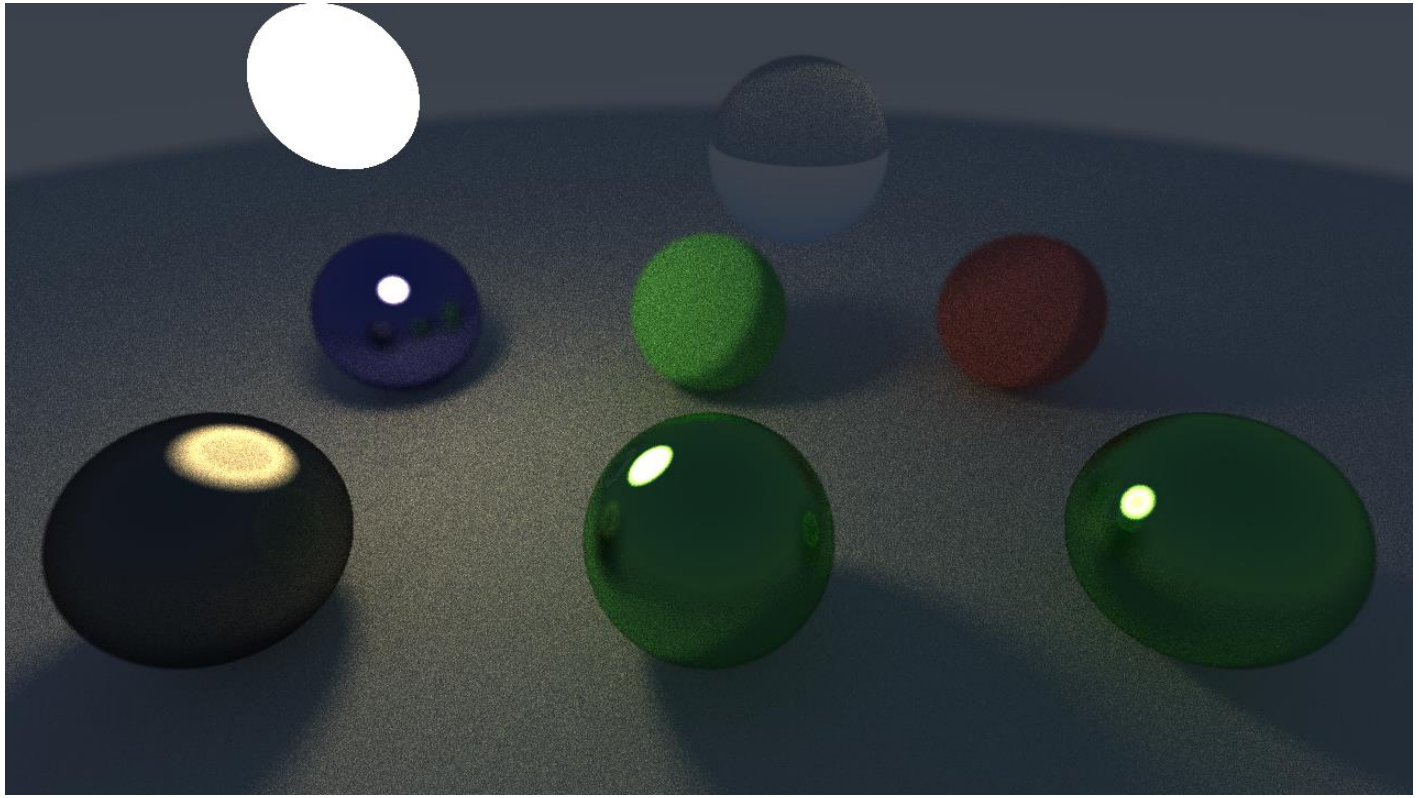
With Defocus Blur



w/o Defocus Blur

Direct Light Sampling

- You can remove these noises if you are using direct light sampling



PA4 Link

1. Login to github
2. Go to following link – https://classroom.github.com/a/EoH-aGPp
3. Accept the assignment