Image Rendering Based on Ray Tracing for Different Materials

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Background

- My project this summer composed of research and coding in association with computer graphics

- To render images I worked with ray tracing methods and three different materials

- Ray Tracing: a physically based rendering method that traces the path of light from the viewer to an object to a light source

- Image Rendering: the process of displaying an image using a 2D or 3D model, by means of computer programs

- My objective was to create a ray tracing engine and use it to render images with different materials
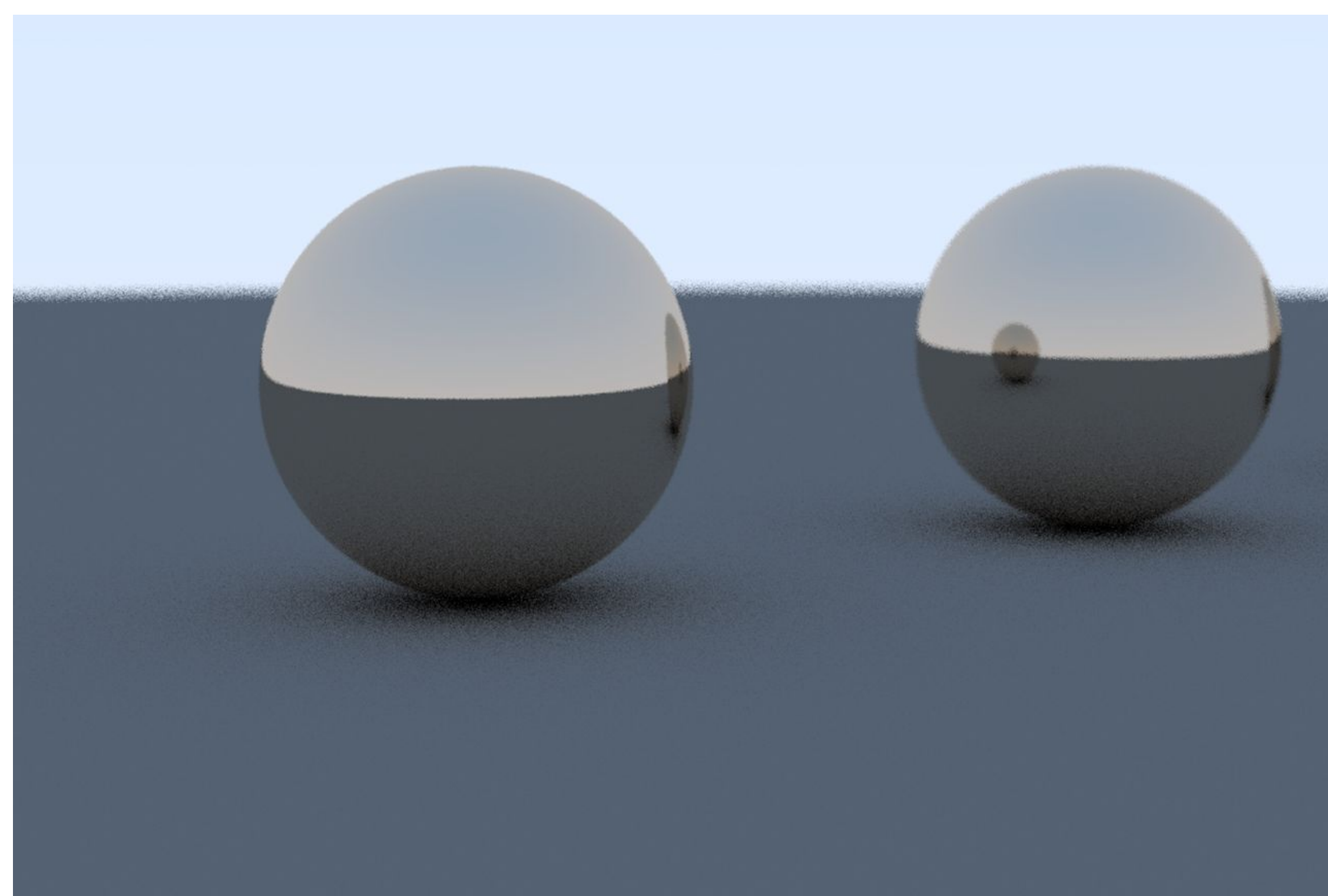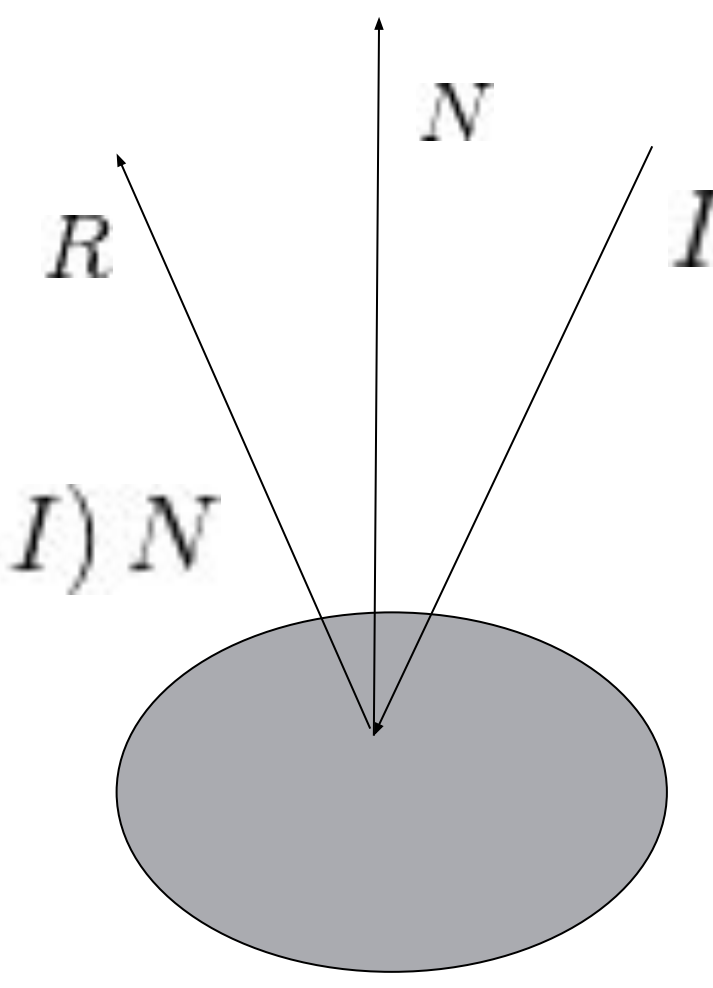
Diffuse Material

- Image I rendered with diffuse material

- Rejection method

- Pick random point on sphere, send ray from hit point to that point

- Reject points that are outside the sphere
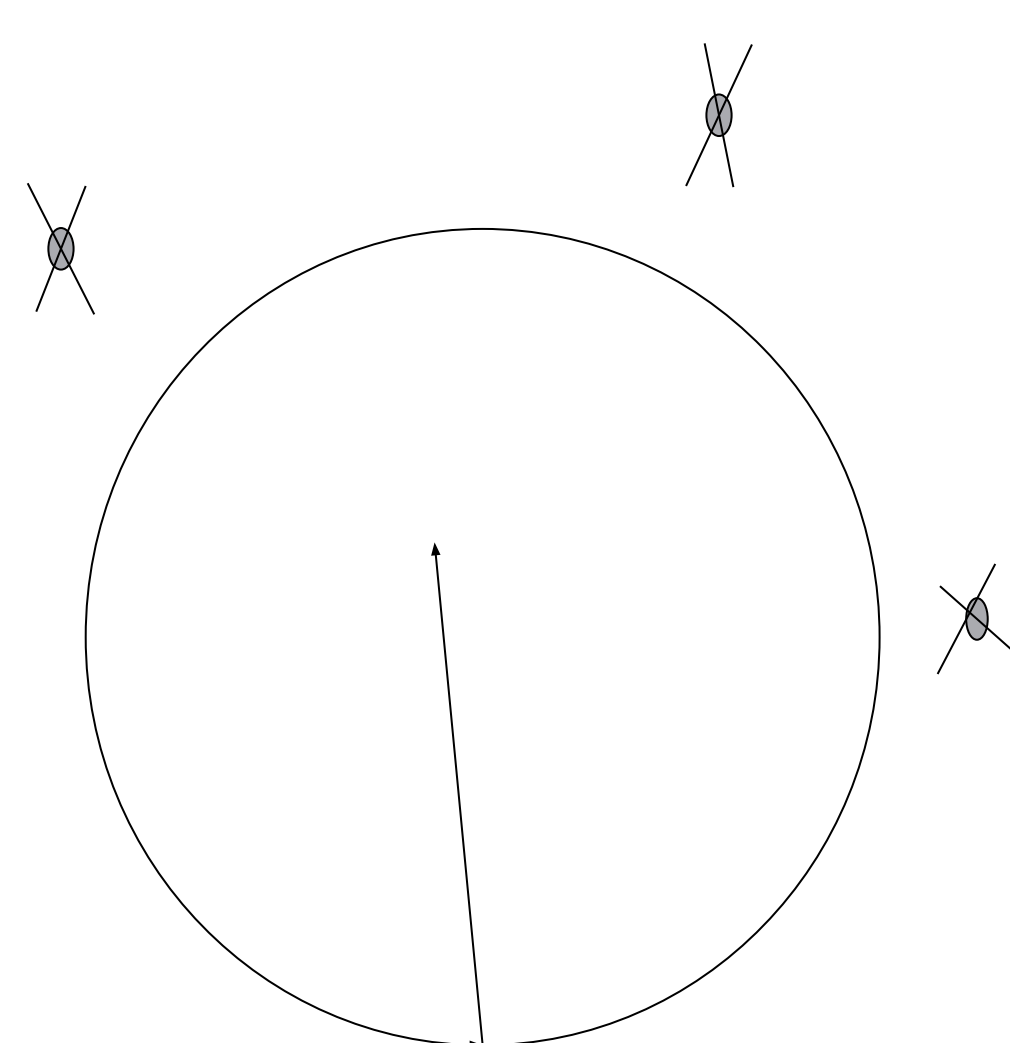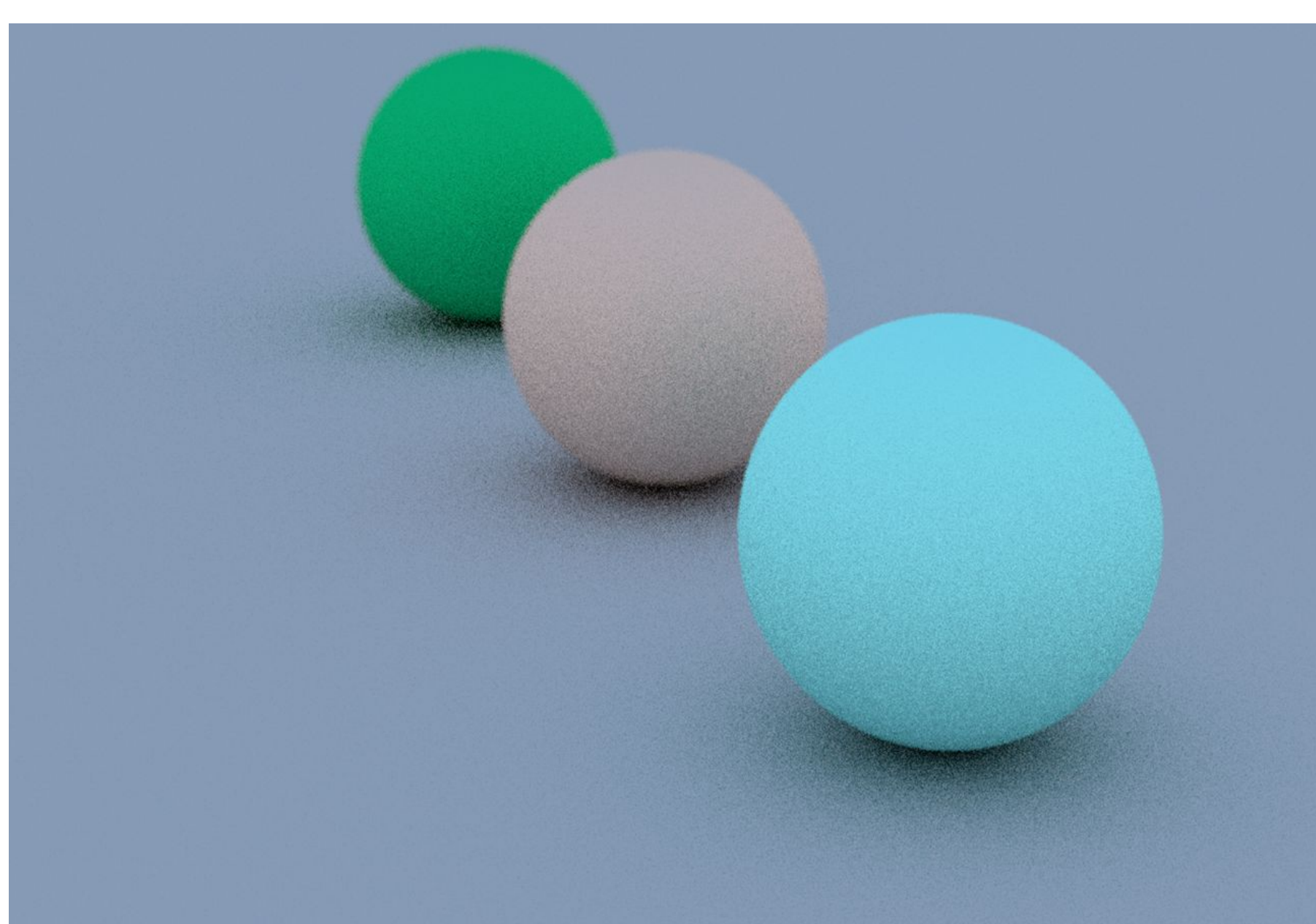
Metal Material

- Simulate Reflection

- The formula: $R = I - 2(N \cdot I)N$

- Image I rendered with metal material:

Dielectric Material

- Simulate Refraction

- Formula based off the law of refraction: $\eta 1 \sin \theta i = \eta 2 \sin \theta t$

- $\eta 1$ and $\eta 2$ are indices of refraction. The index of refraction determines the degree to which the ray direction changes when it passes through a medium

- Images I rendered of dielectric material:

water

glass

diamond
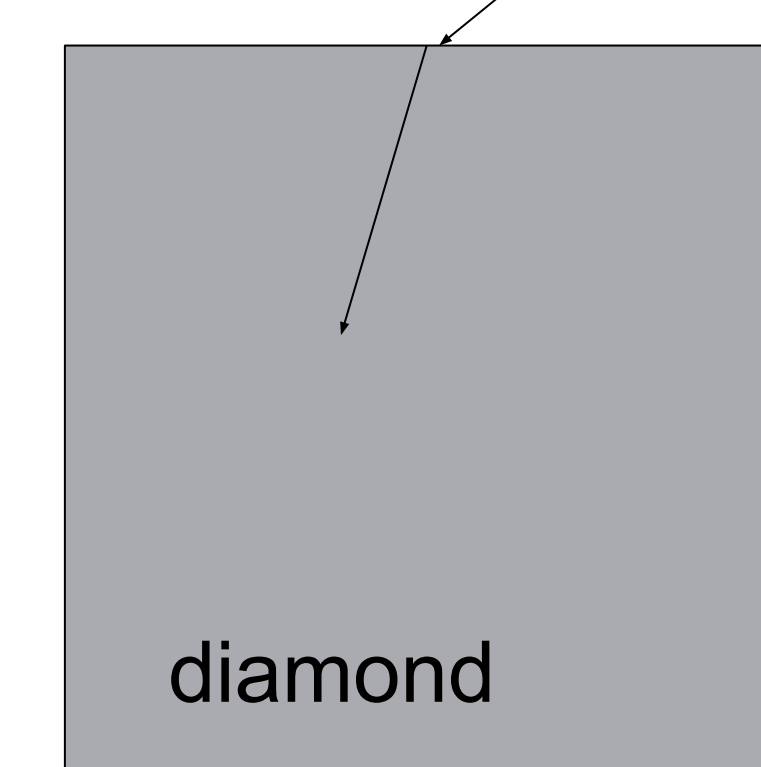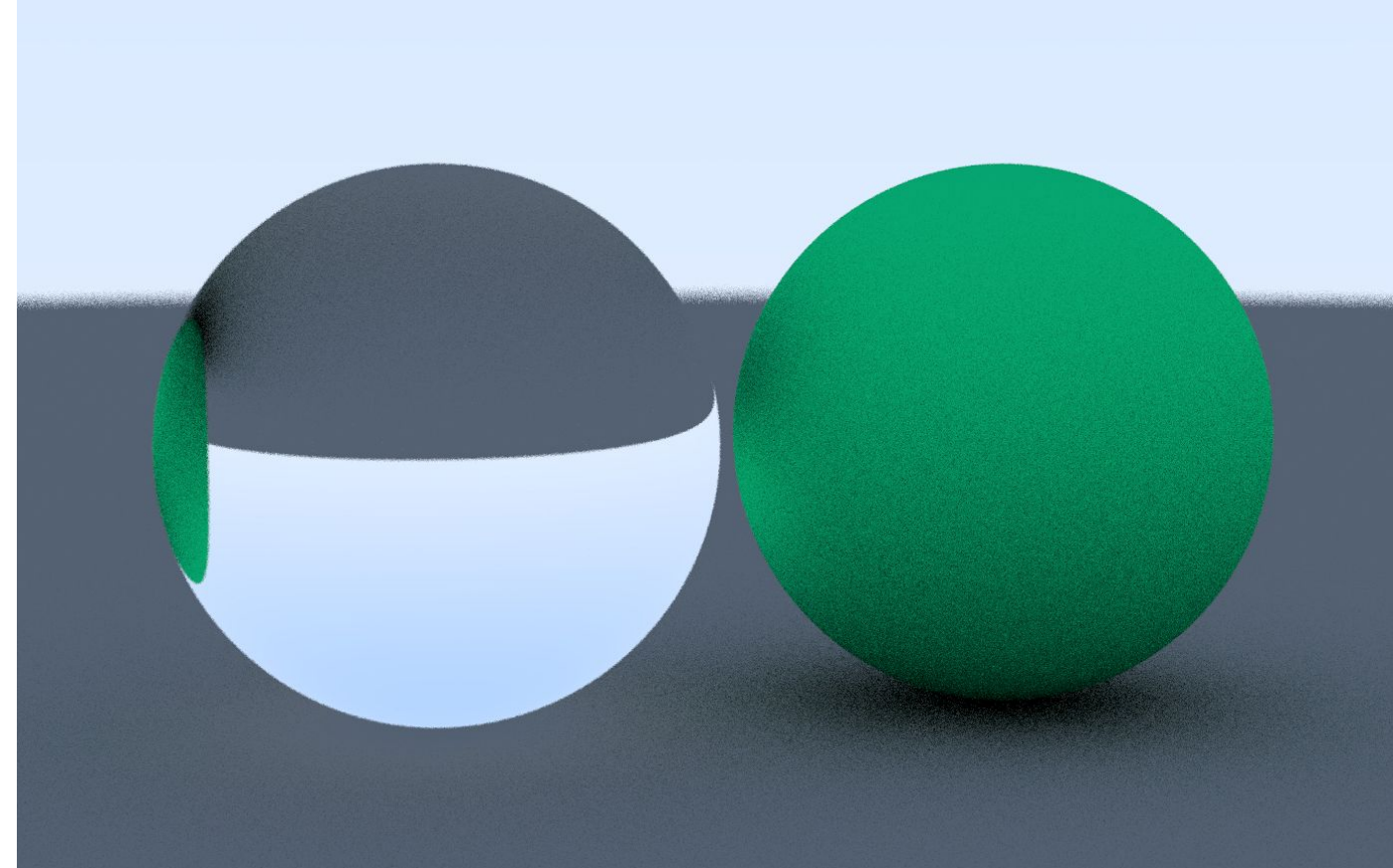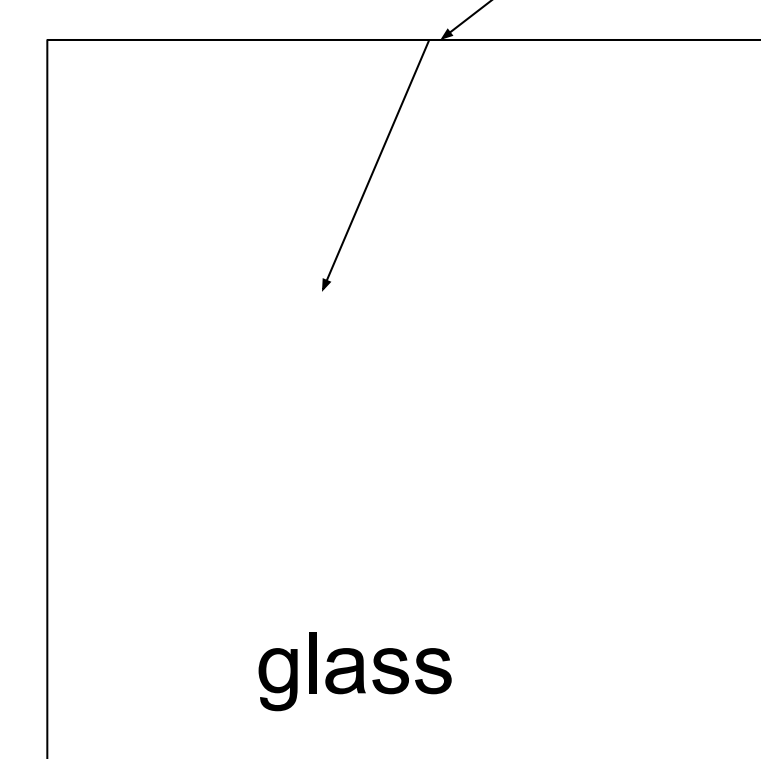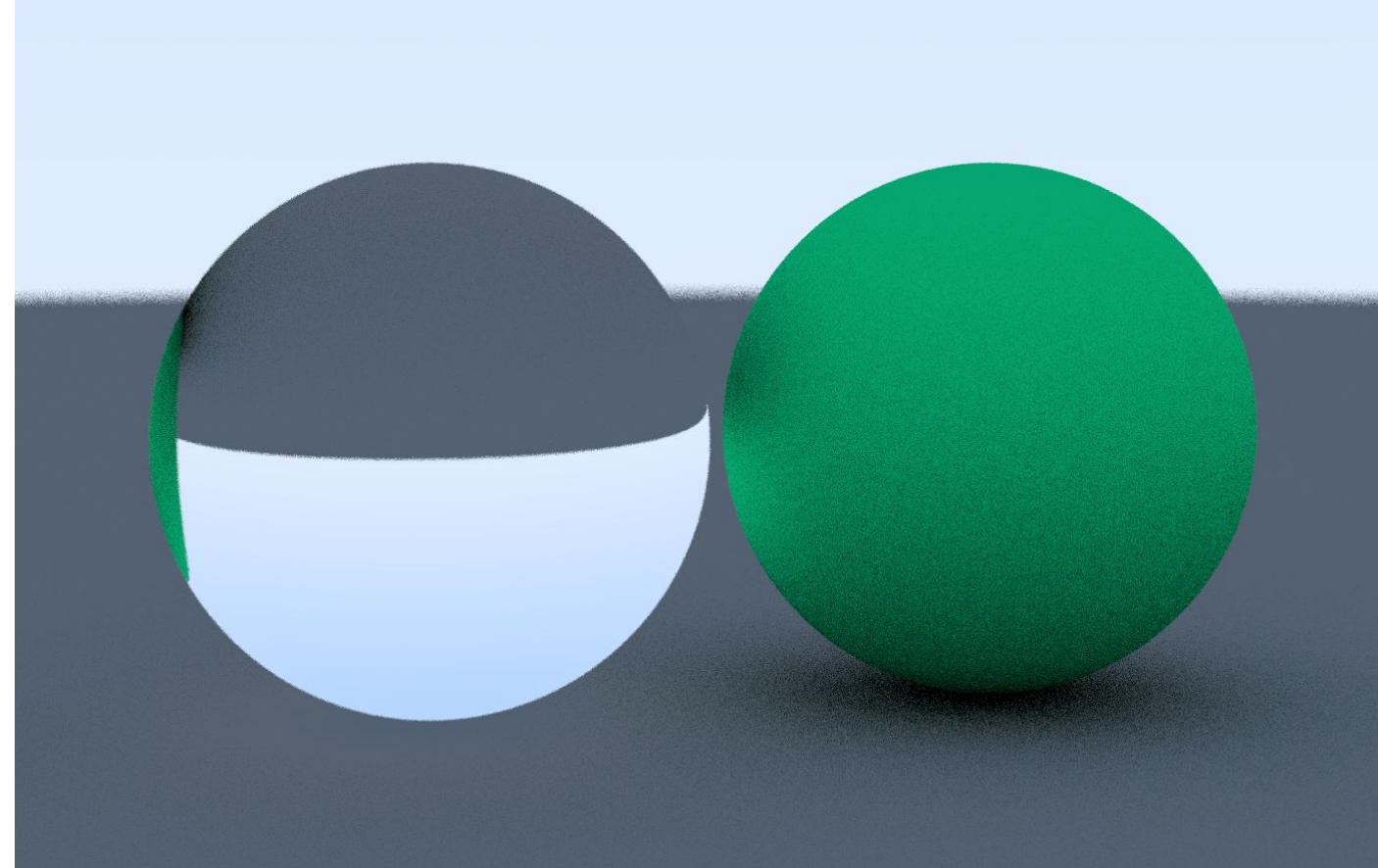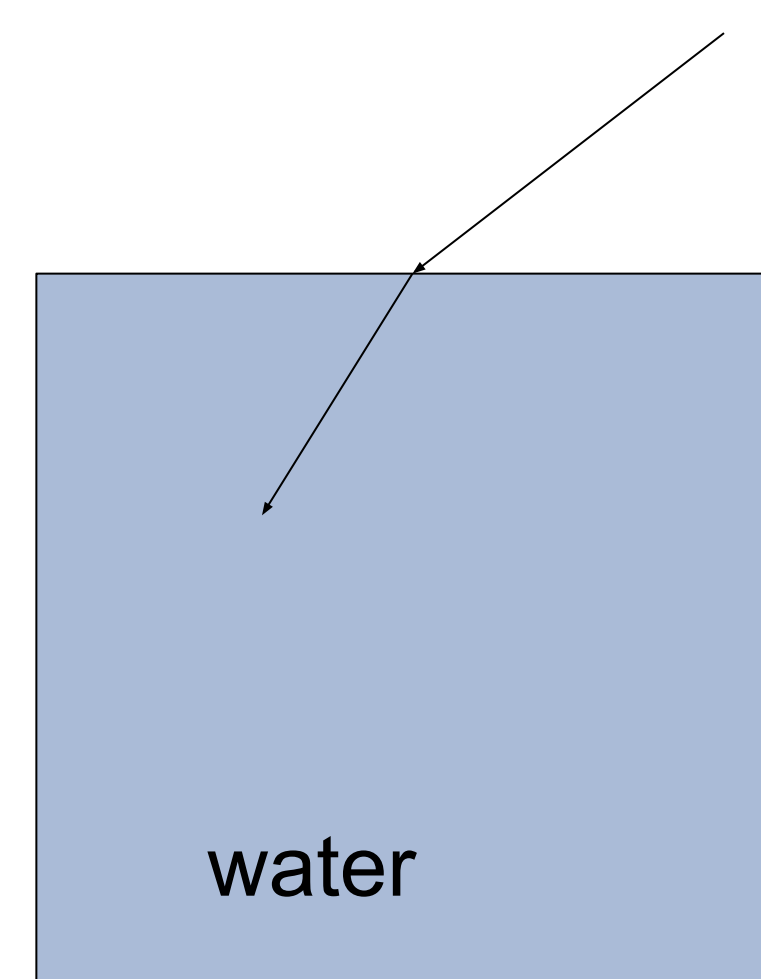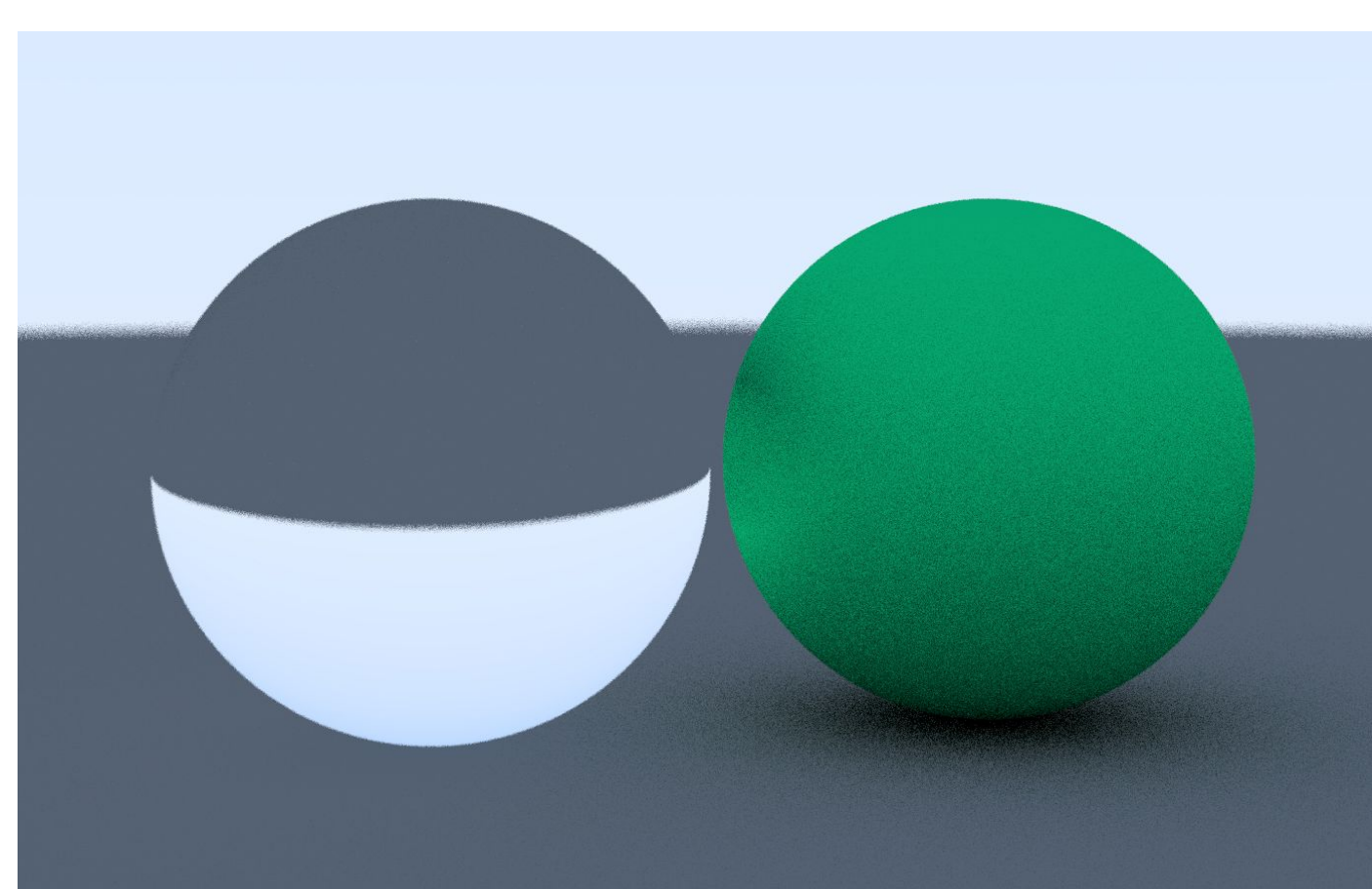
Generating Camera Rays

- The position of the camera and where it is looking determines the appearance of the object you are rendering

- Camera Rays are the rays sent from the camera origin, through a pixel, to be intersected with an object

- Rays in general are used for gathering information on the color of objects, computing shadows, and doing computation for the visibility between two points

- Results with all three materials and different camera angles with colors:
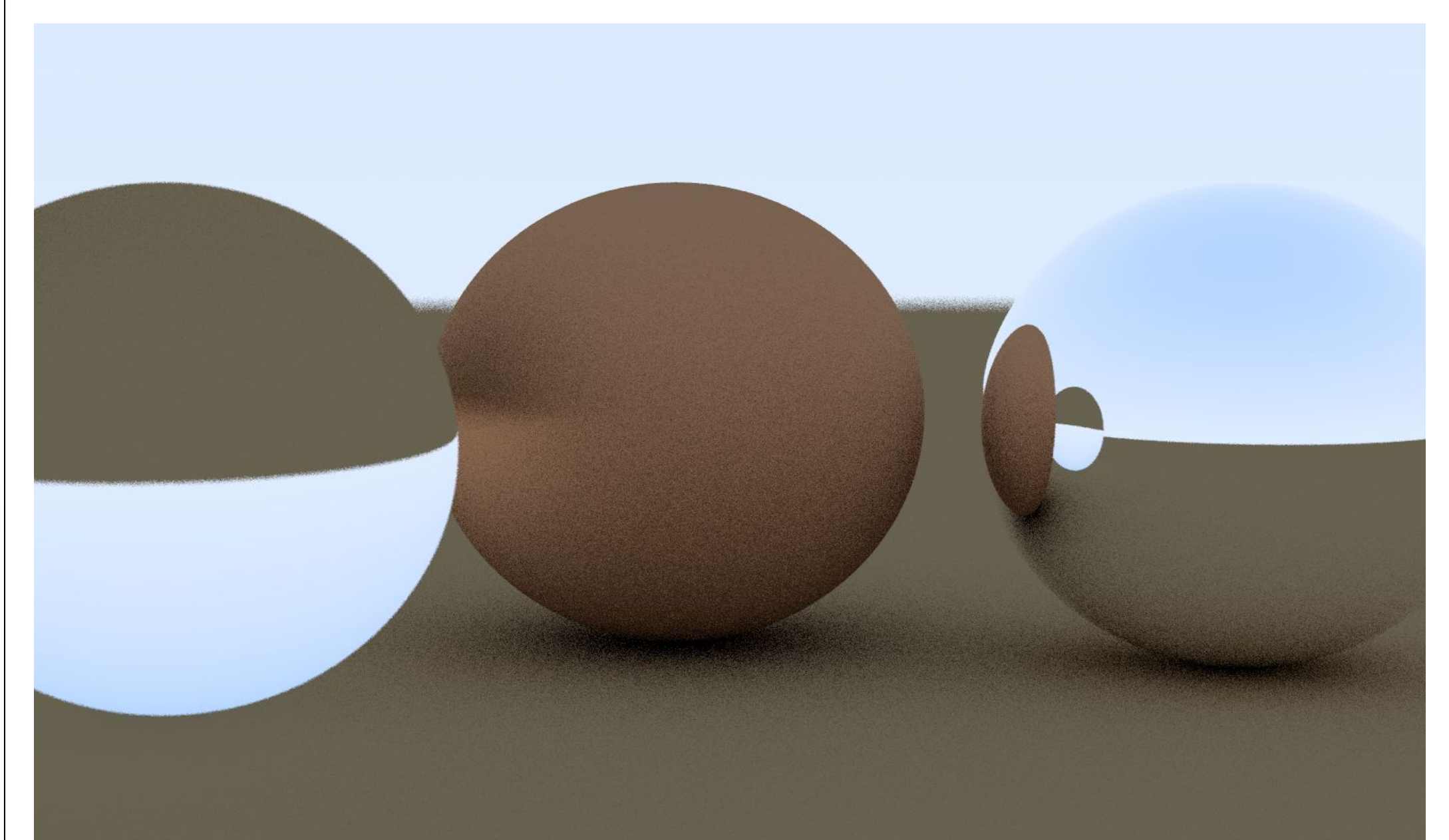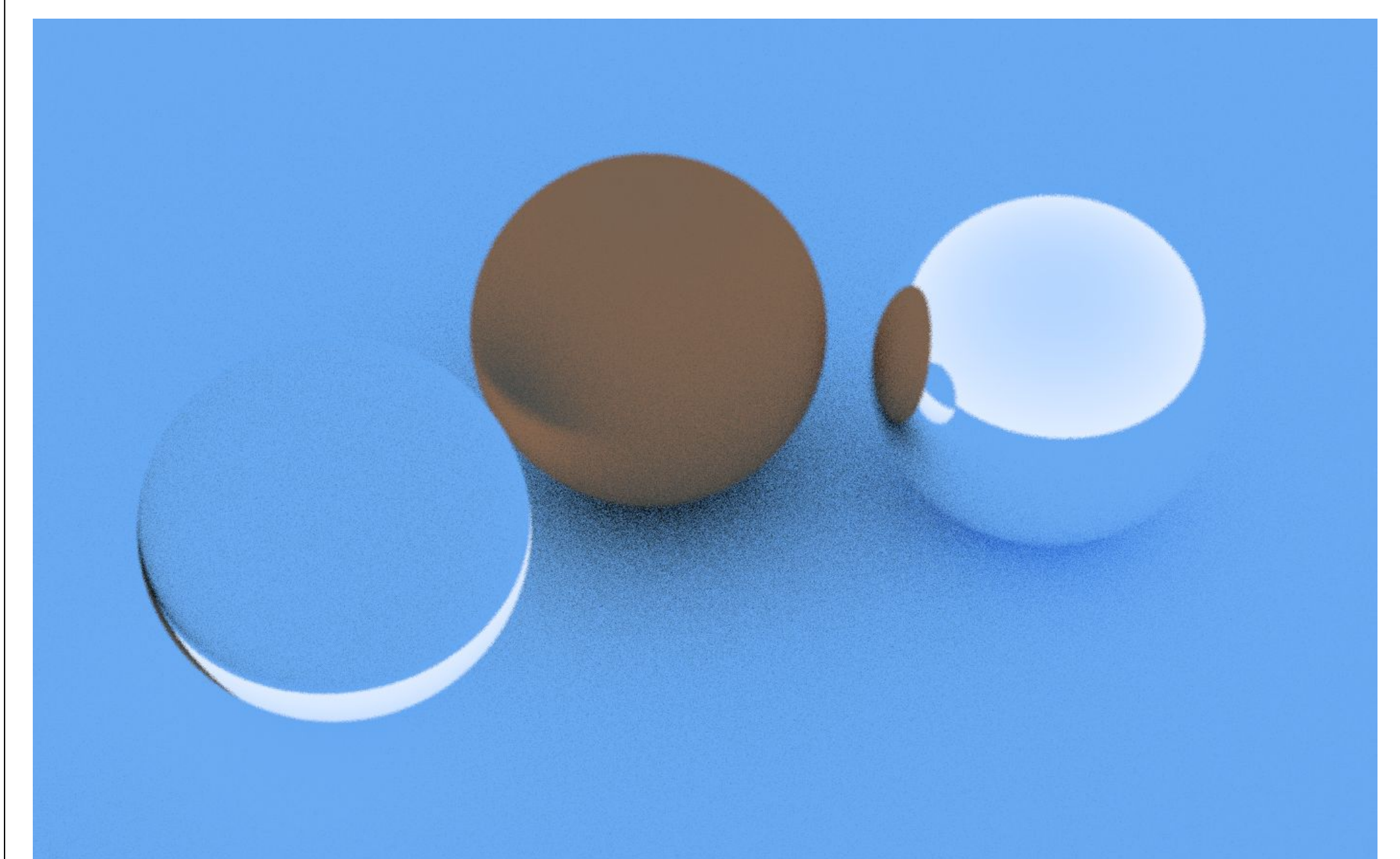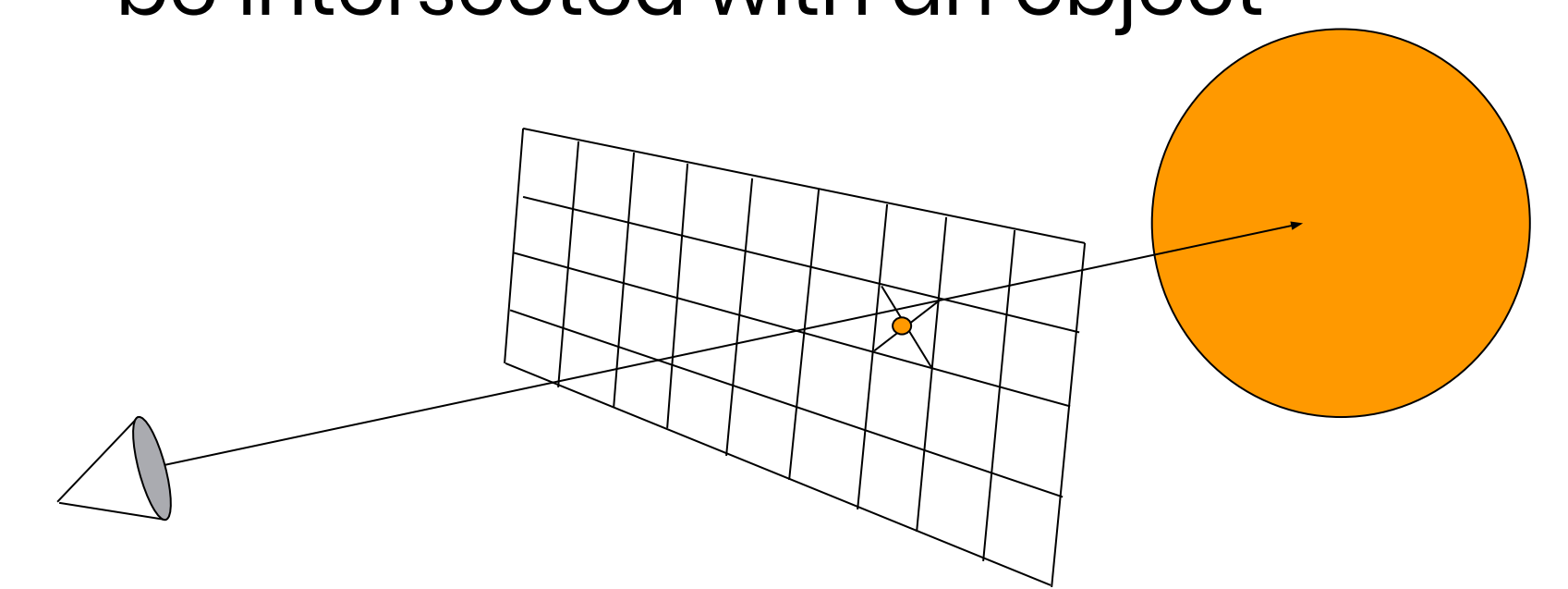
Future of the Field

- Due to modern technology Ray Tracing could be the new form of computer graphics for video games

- With hybrid Graphics techniques that combine Ray Tracing and Rasterization the graphics of video games will continue to progress

Rasterized

Ray traced