CS130 : Computer Graphics

Lecture 20: Ray Tracing

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Ray Tracing

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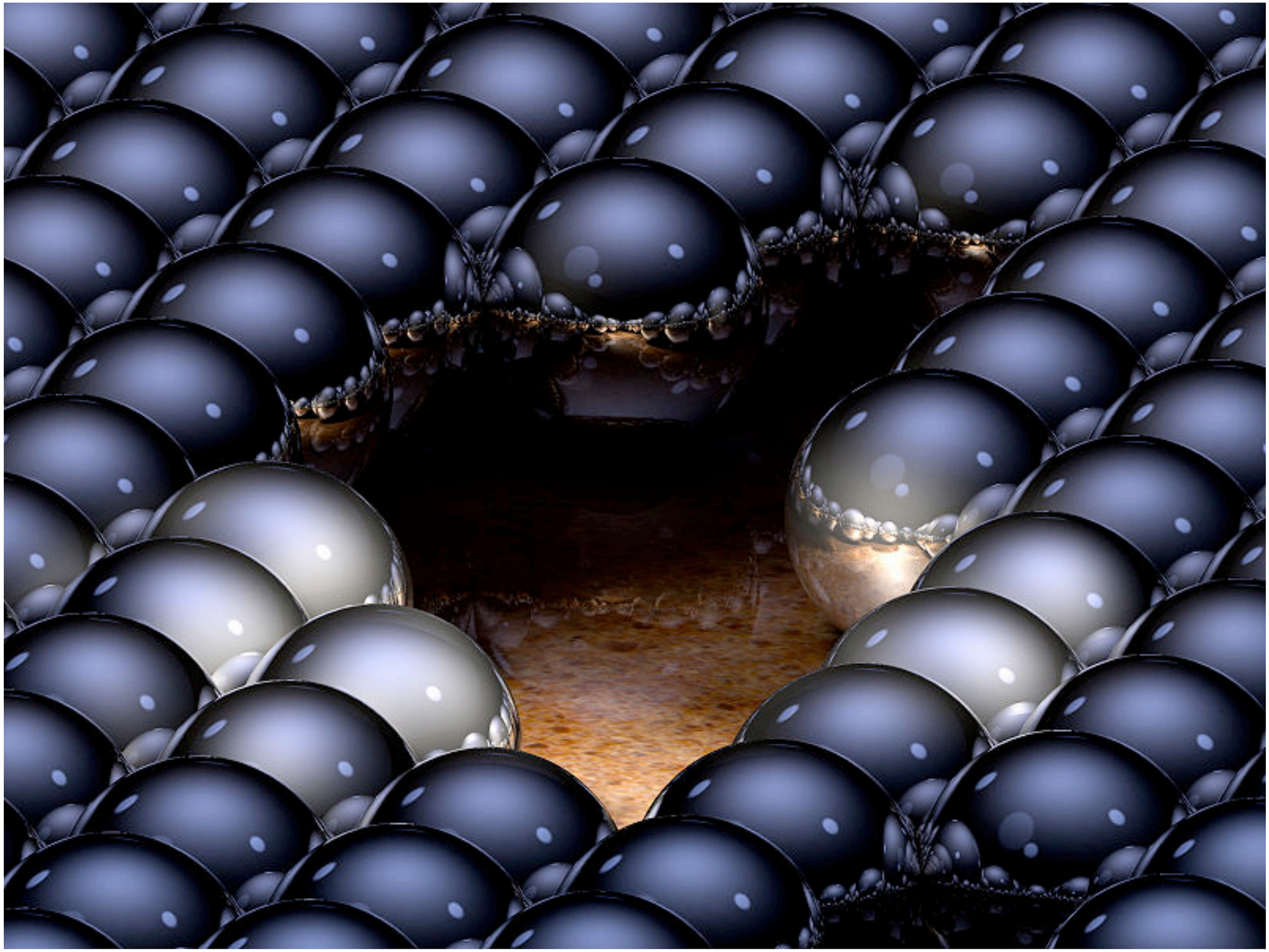
shallow depth of field, area light sources, diffuse interreflection



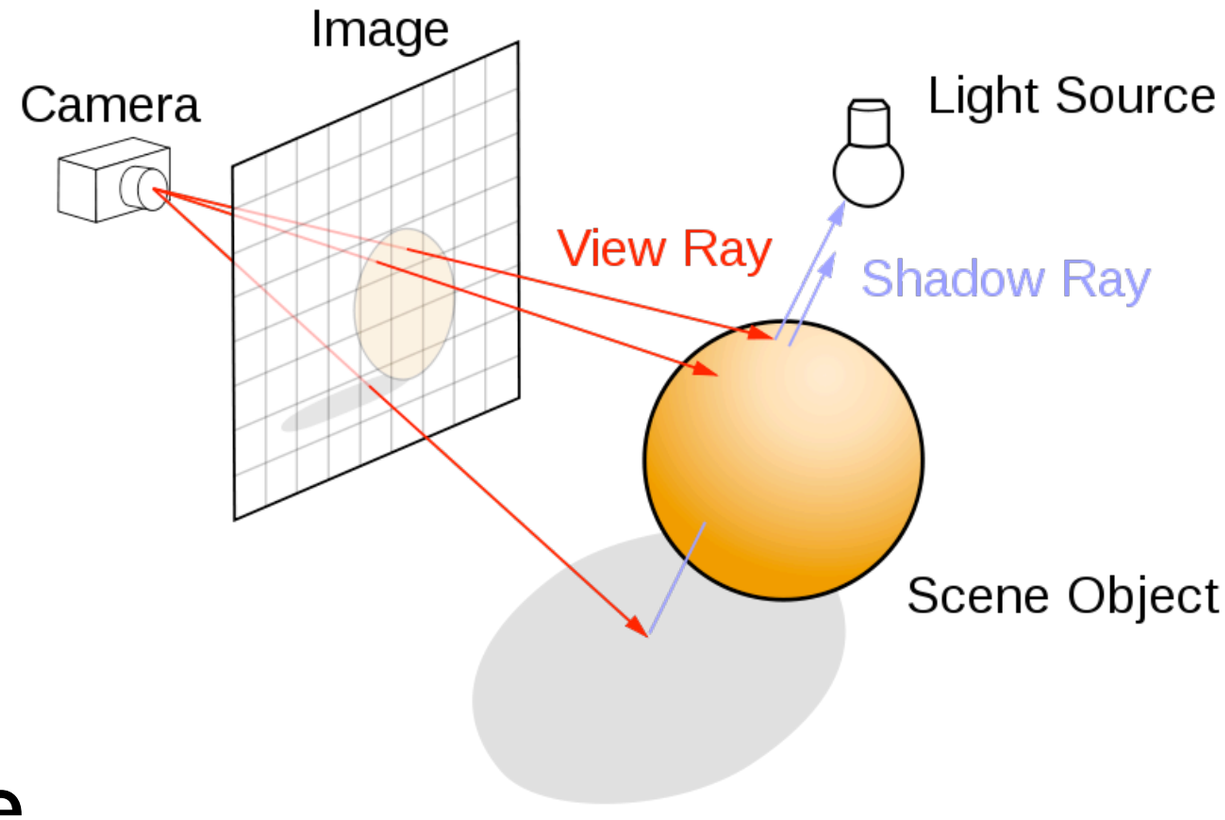
Greg L., Wikimedia Commons

up to 16 reflections per ray

Basic Algorithm

for each pixel

1. **cast view ray**: compute view ray from camera through pixel into scene
2. **intersect**: find intersection of ray with closest object
3. **shade**: compute the color of the intersection point



Ray Tracing Program

```
for each pixel do
    compute viewing ray
    if ( ray hits an object with t in [0, inf] ) then
        compute n
        evaluate shading model and set pixel to that color
    else
        set pixel color to the background color
```

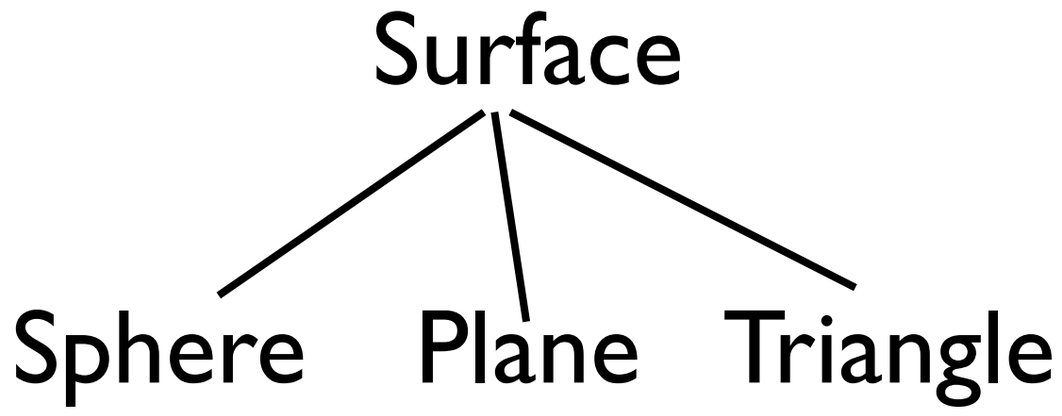
Recursive ray tracing

```
ray = ray(e,d,t0,t_max)

function ray_color(ray)
    if (Intersection(ray)) then
        point = ray.Point(ray.t_max)
        color c = color_ambient
        if (! Intersection(ray(point,l,eps,inf))
          h = halfway_vector
          c = c + color_diffuse + color_specular
          c = c + k_m * ray_color(ray(point,r,eps,inf))
    else
        color c = background color
```

Object-oriented design

```
class Surface
{
    public:
        void Intersection(RAY& ray)=0;
        Box Bounding_Box()=0;
}
```



Other objects: Ray, Light,
Material, Camera, Film, World