

PRECEPT 10

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Finally.....

Rasterizer

- Gouraud/Phong Shading
 - Ambient
 - Diffuse
 - Specular

$$I = K_A I_{AL} + \sum_i \left(K_D (N \cdot L_i) I_i + K_S (V \cdot R_i)^n I_i \right)$$

Rasterizer

- Diffuse

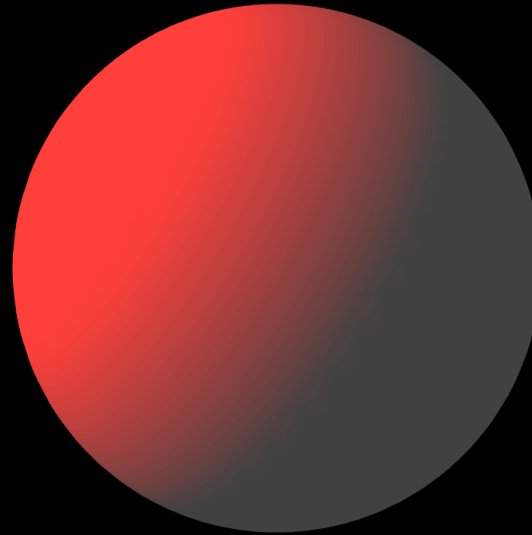


ambient	#444444
diffuse	#990000
specular	#000000

$$I = K_A I_{AL} + \sum_i \left(K_D (N \cdot L_i) I_i + K_S (V \cdot R_i)^n I_i \right)$$

Rasterizer

- Diffuse



ambient	#444444
diffuse	#990000
specular	#000000

$$I = K_A I_{AL} + \sum_i \left(K_D (N \cdot L_i) I_i + K_S (V \cdot R_i)^n I_i \right)$$

>0?

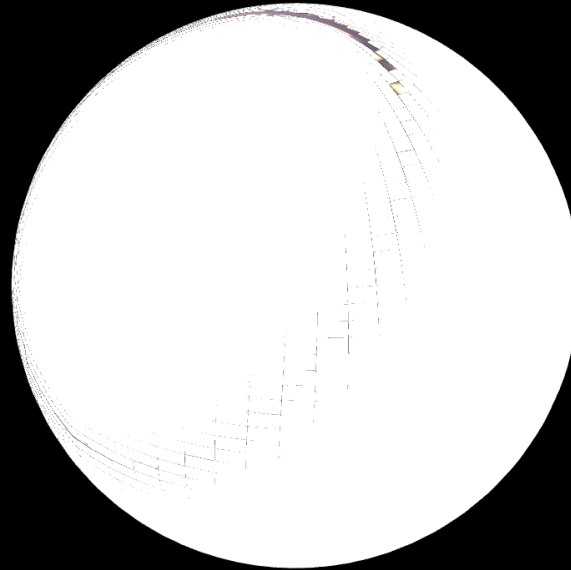
Rasterizer

- Specular
 - Viewer's vector:
cameraPosition – position
 - Reflect vector
 - n -> shininess

$$I = K_A I_{AL} + \sum_i \left(K_D (N \cdot L_i) I_i + K_S (V \cdot R_i)^n I_i \right)$$

Rasterizer

- Specular



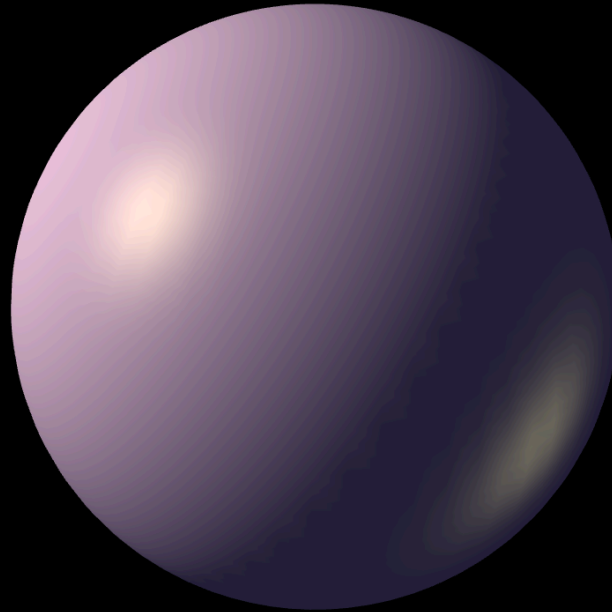
ambient	#252137
diffuse	#705d5d
specular	#4a4a28
shininess	10

Close Controls

$$I = K_A I_{AL} + \sum_i \left(K_D (N \cdot L_i) I_i + K_S (V \cdot R_i)^n I_i \right)$$

Rasterizer

- Specular



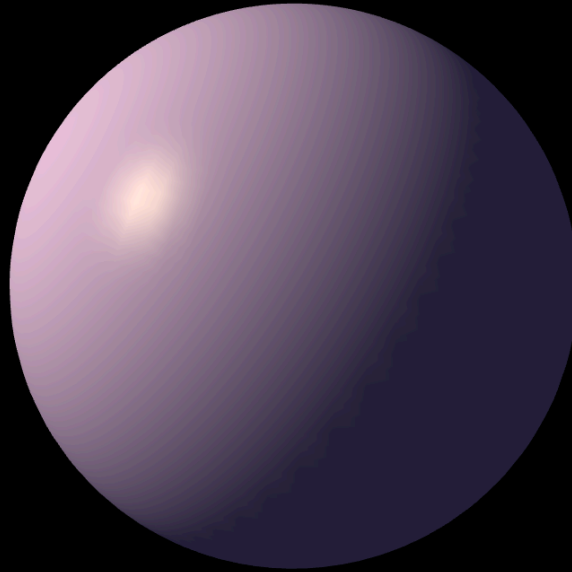
ambient	#252137
diffuse	#705d5d
specular	#4a4a28
shininess	15

Close Controls

$$I = K_A I_{AL} + \sum_i \left(K_D (N \cdot L_i) I_i + K_S (V \cdot R_i)^n I_i \right)$$

Rasterizer

- Specular



ambient	#252137
diffuse	#705d5d
specular	#4a4a28
shininess	<input type="range" value="30"/> 30

Close Controls

$$I = K_A I_{AL} + \sum_i \left(K_D (N \cdot L_i) I_i + K_S (V \cdot R_i)^n I_i \right)$$

Ray tracer

- Intersections
- Phong reflectance model
- Refraction

Intersections

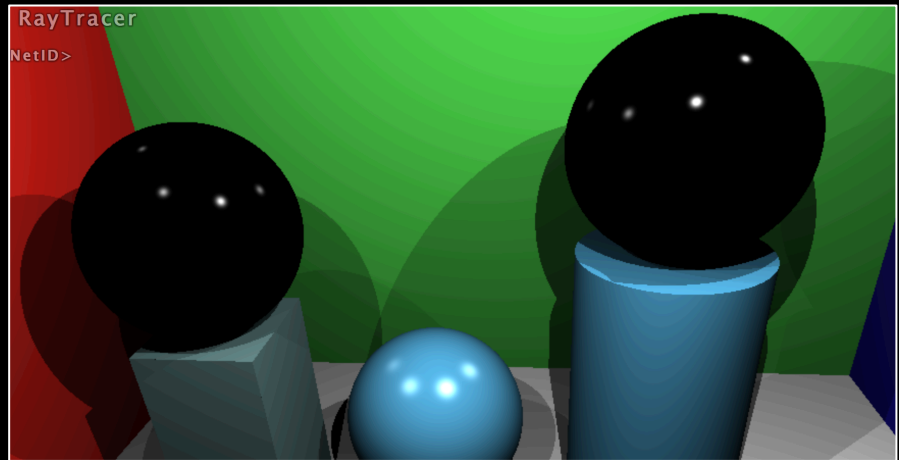
- Sphere

```
intersect.position = rayGetOffset(ray, len);
```

```
len1 = ... - ...
```

```
len2 = ... + ...
```

```
return len1;
```



Intersections

- Sphere

```
intersect.position = rayGetOffset(ray, len);
```

```
len1 = ... - ...
```

```
len2 = ... + ...
```

```
len = INFINITY;
```

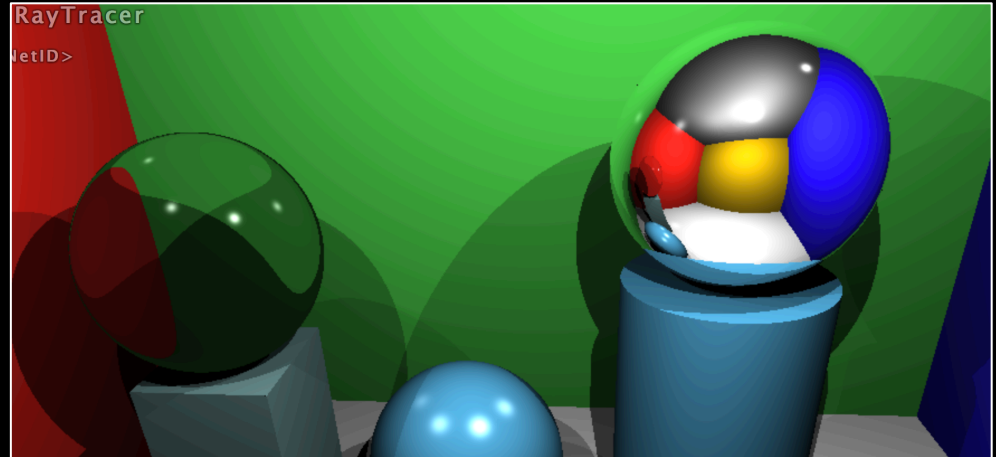
```
if (len1 > EPS)
```

```
    len = len1;
```

```
else if (len2 > EPS)
```

```
    len = len2;
```

```
return len;
```



Intersections

- Box

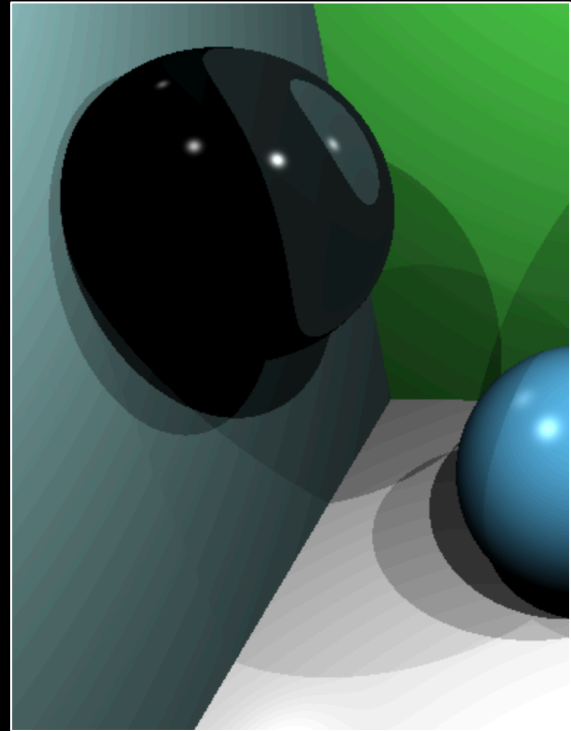
- Step 1:

- Intersect with plane:

- `//Left1`

- `Norm : (-1, 0, 0);`

- `dist : -xmin`



Intersections

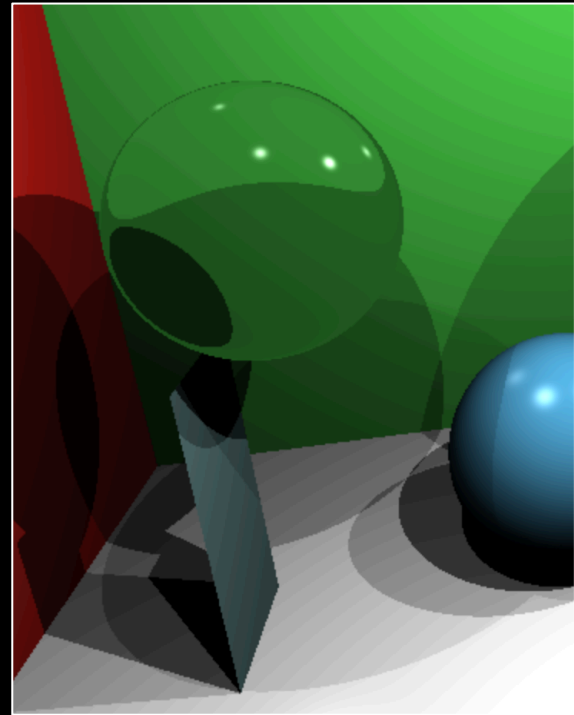
- Box

- Step 2:

- Check it's on the surface?

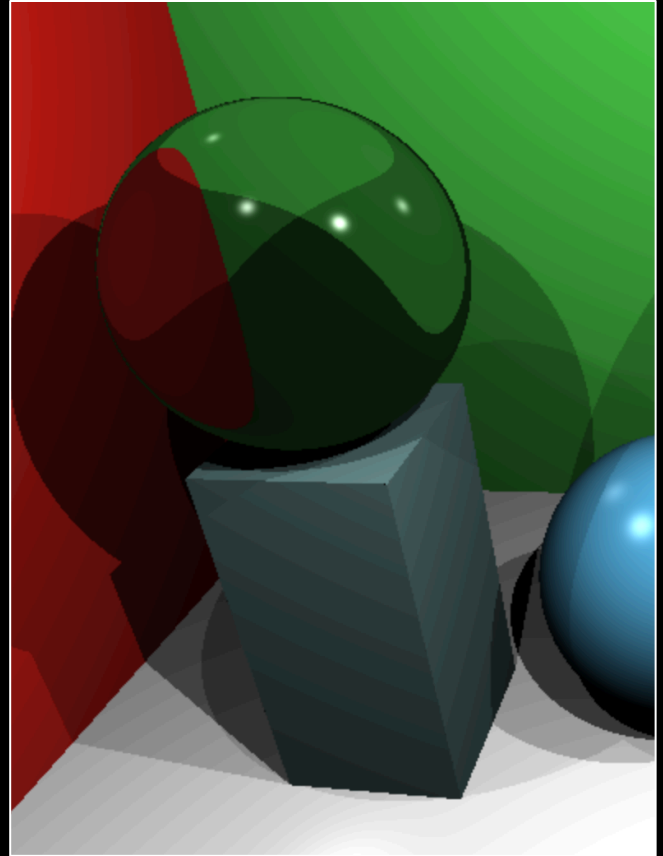
- $\text{pointY} < \text{maxY} + \text{EPS}$

- $\text{pointY} > \text{minY} - \text{EPS}$



Intersections

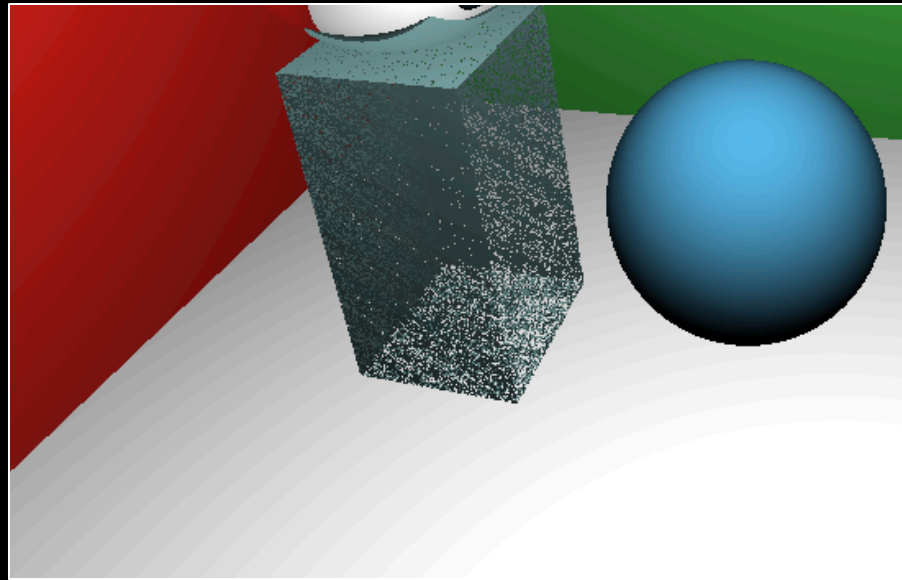
- Box
 - Step 3:
Find the closest intersection.



Intersections

- Box

If not using EPS...





When to use EPS?

EPS Issue

- When we need to determine whether x is in some range $[a, b]$, then we do.... (eg. color it)

$$x > a - \text{EPS} \ \&\& \ x < a + \text{EPS}$$

- $(x == 0)$ it's on the plane!
- ✓ $(x > -\text{EPS} \ \&\& \ x < \text{EPS})$ it's on the thin surface ...

Phong reflectance model

- Attenuation:

$$1 / (\text{light's attenuation} \times d^2)$$

Intersections

- Cylinders
- Cones

see last precept...

Refractions

Others

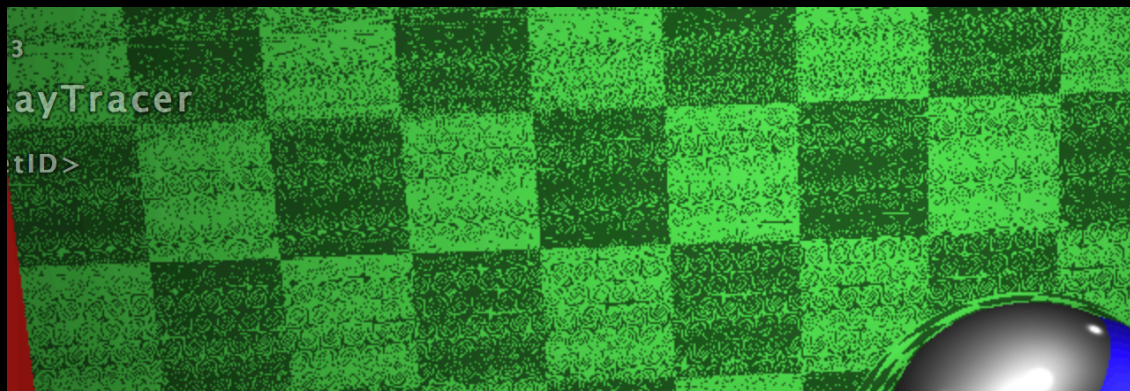
- Checkerboard
 - Different functions

Others

- Checkerboard

- Different functions

- A simplest one is : $\text{mod}(\text{floor}(x)+\text{floor}(y)+\text{floor}(z), 2.0)$ (need to change the scale)



Others

- Checkerboard

- Different functions

- A simplest one is : $\text{mod}(\text{floor}(x)+\text{floor}(y)+\text{floor}(z), 2.0)$

EPS TRICK!!!

Others

- Environment Map
 - Do reflection as usual
 - Get UV vector: transfer 3D position to uv coordinate
 - Reference:
http://en.wikipedia.org/wiki/Spherical_coordinate_system#Coordinate_system_conversions (need to change the order of x, y, z!)



Thanks!