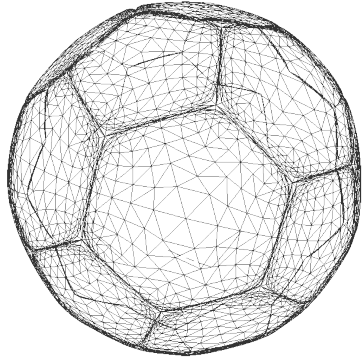


Lighting - Shading

Evangelou Iordanis

Model loading



An *.obj file consist of :

- vertex coordinates

```
v 1.5 1.5 1.5  
v 1 1 1  
v 0.5 0.5 0.5  
[..]
```

- texture coordinates

```
vt 1 0 0  
vt 1 1 0  
vt 0 1 0  
[..]
```

- normal coordinates

```
vn 0 1 0  
vn 0 1 0  
vn 0 1 0  
[..]
```

- faces

```
f 0/0/0 1/1/1 2/2/2  
f 0/0/0 3/3/3 2/2/2  
f 0/0/0 3/3/3 4/4/4  
[..]
```

- a name to an *.mtl file

```
mtllib material.mtl
```

- a per-face group material

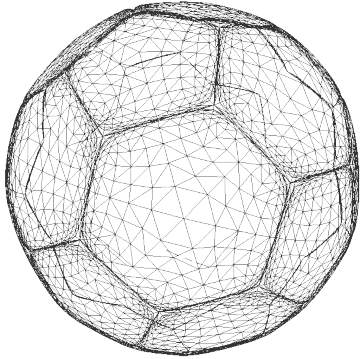
```
g __group_name__  
usemtl __ball__
```

Model loading

The *.mtl file format* is :

```
newmtl __ball__  
Ns 127.0000  
Ka 0.5880 0.5880 0.5880  
Kd 0.5880 0.5880 0.5880  
Ks 0.4 0.4 0.4  
map_Ka maps\ball_ambient_tex.png  
map_Kd maps\ball_diffuse_tex.png  
map_Ks maps\ball_specular_tex.png
```

Shininess / glossy factor : [0, 127]

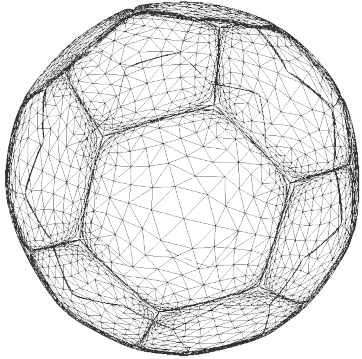


Model loading

The *.mtl file format* is :

```
newmtl __ball__  
Ns 127.0000  
Ka 0.5880 0.5880 0.5880  
Kd 0.5880 0.5880 0.5880  
Ks 0.4 0.4 0.4  
map_Ka maps\ball_ambient_tex.png  
map_Kd maps\ball_diffuse_tex.png  
map_Ks maps\ball_specular_tex.png
```

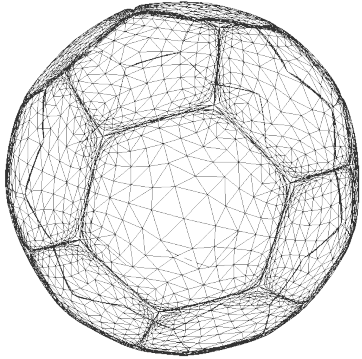
Ambient color rgb : [0, 1]



Model loading

The *.mtl file format* is :

```
newmtl __ball__  
Ns 127.0000  
Ka 0.5880 0.5880 0.5880  
Kd 0.5880 0.5880 0.5880  
Ks 0.4 0.4 0.4  
map_Ka maps\ball_ambient_tex.png  
map_Kd maps\ball_diffuse_tex.png  
map_Ks maps\ball_specular_tex.png
```

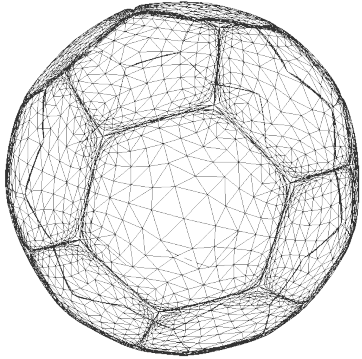


Diffuse color rgb : [0, 1]

Model loading

The *.mtl file format* is :

```
newmtl __ball__  
Ns 127.0000  
Ka 0.5880 0.5880 0.5880  
Kd 0.5880 0.5880 0.5880  
Ks 0.4 0.4 0.4  
map_Ka maps\ball_ambient_tex.png  
map_Kd maps\ball_diffuse_tex.png  
map_Ks maps\ball_specular_tex.png
```

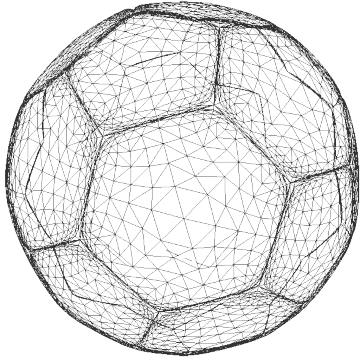


Specular color rgb : [0, 1]

Model loading

The *.mtl file format* is :

```
newmtl __ball__  
Ns 127.0000  
Ka 0.5880 0.5880 0.5880  
Kd 0.5880 0.5880 0.5880  
Ks 0.4 0.4 0.4  
map_Ka maps\ball_ambient_tex.png  
map_Kd maps\ball_diffuse_tex.png  
map_Ks maps\ball_specular_tex.png
```

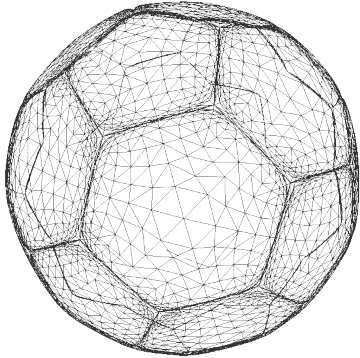


Ambient texture file

Model loading

The *.mtl file format* is :

```
newmtl __ball__  
Ns 127.0000  
Ka 0.5880 0.5880 0.5880  
Kd 0.5880 0.5880 0.5880  
Ks 0.4 0.4 0.4  
map_Ka maps\ball_ambient_tex.png  
map_Kd maps\ball_diffuse_tex.png  
map_Ks maps\ball_specular_tex.png
```

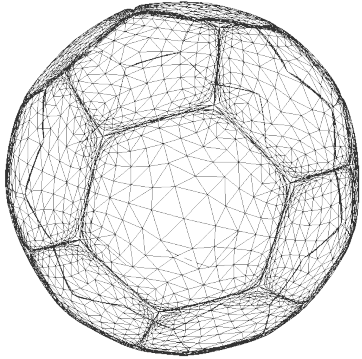


Diffuse texture file

Model loading

The *.mtl file format* is :

```
newmtl __ball__  
Ns 127.0000  
Ka 0.5880 0.5880 0.5880  
Kd 0.5880 0.5880 0.5880  
Ks 0.4 0.4 0.4  
map_Ka maps\ball_ambient_tex.png  
map_Kd maps\ball_diffuse_tex.png  
map_Ks maps\ball_specular_tex.png
```

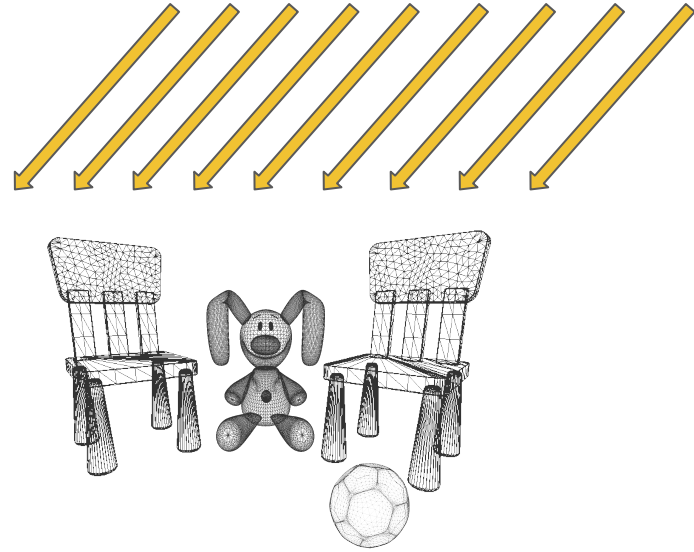


Specular texture file

Light emitters

- Directional light emitter

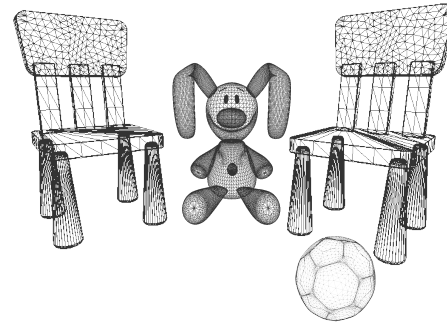
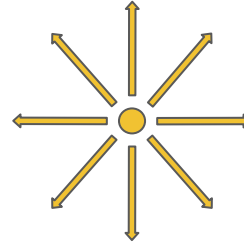
	Direction	Source	Attenuation
Directional	✗	—	—



Light emitters

- Point light emitter

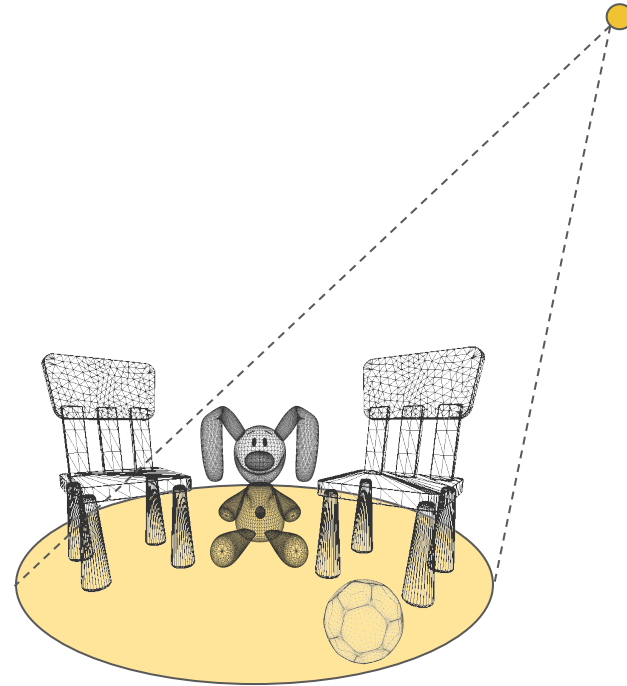
	Direction	Source	Attenuation
Directional	✗	—	—
Point	—	✗	✗



Light emitters

- Point light emitter

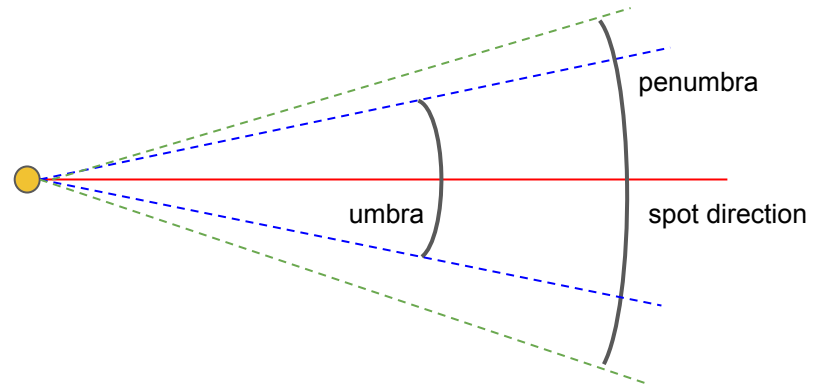
	Direction	Source	Attenuation
Directional	✗	—	—
Point	—	✗	✗
Spot	✗	✗	✗



Light emitters

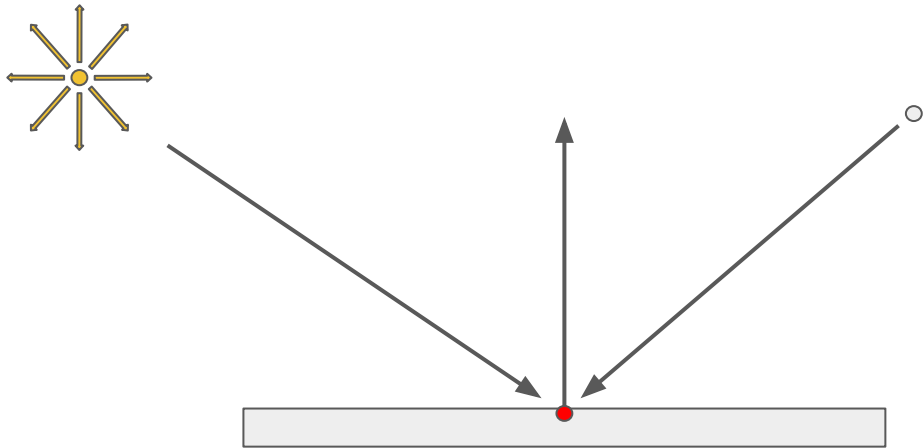
- Point light emitter

	Direction	Source	Attenuation
Directional	✗	—	—
Point	—	✗	✗
Spot	✗	✗	✗



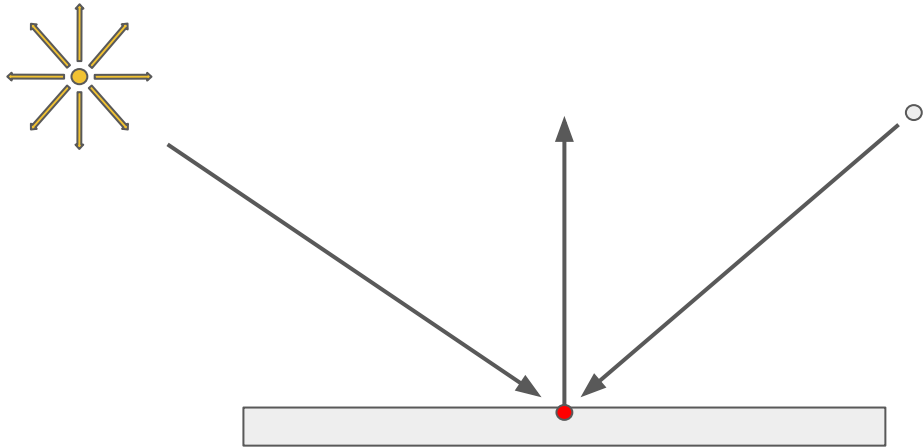
Shading

- Approximate direct illumination with BRDF
 - Blinn - Phong model

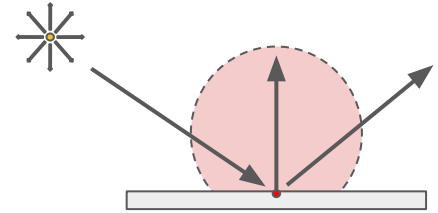


Shading

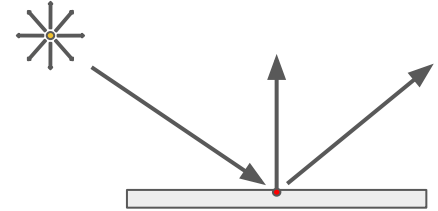
- Approximate direct illumination with BRDF
 - Blinn - Phong model



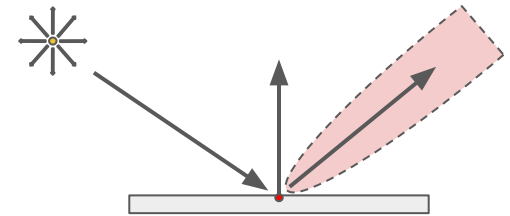
Diffuse



Specular

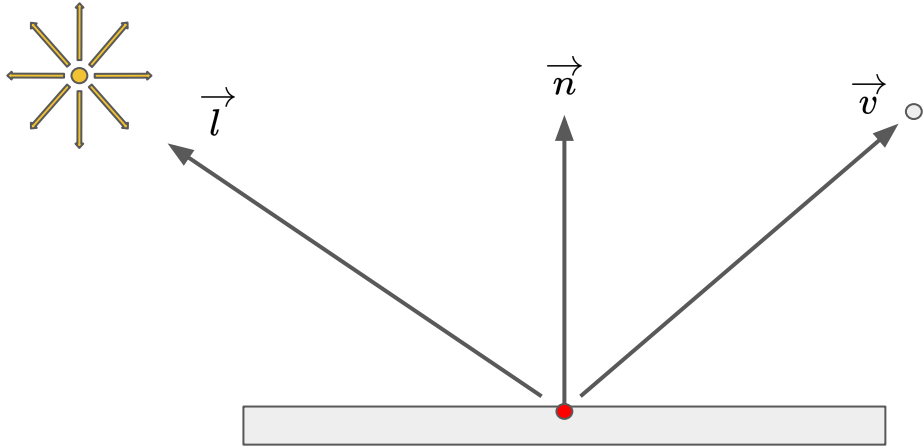


Glossy



Shading

- Approximate direct illumination with BRDF
 - Blinn - Phong model

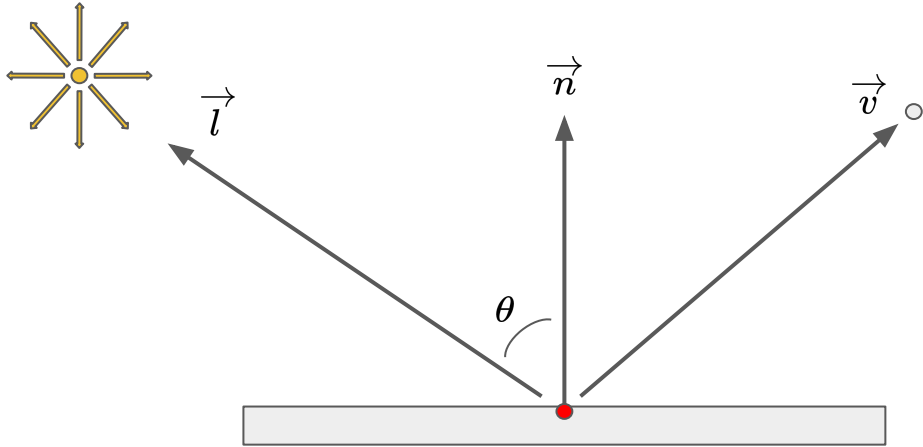


How much “light power” flows from light direction towards the eye sensor.

$$L_o(\omega_o, \omega_i; u) = (k_d \cos \theta + k_s \cos^a \phi) L_i \left(\vec{l} \right)$$

Shading

- Approximate direct illumination with BRDF
 - Blinn - Phong model



How much “light power” flows from light direction towards the eye sensor.

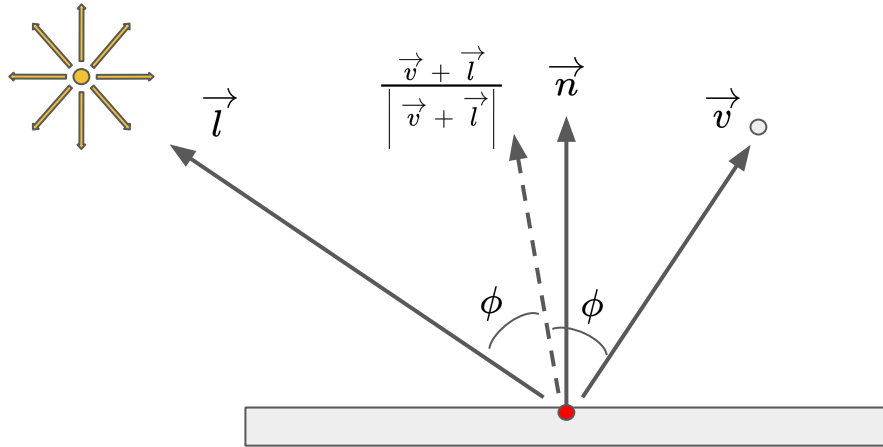
$$L_o(\omega_o, \omega_i; u) = (k_d \cos \theta + k_s \cos^a \phi) L_i(\vec{l})$$

Diffuse reflection:

$$k_d \cos \theta = \frac{\rho}{\pi} (\vec{n} \cdot \vec{l})$$

Shading

- Approximate direct illumination with BRDF
 - Blinn - Phong model



How much “light power” flows from light direction towards the eye sensor.

$$L_o(\omega_o, \omega_i; u) = (k_d \cos \theta + k_s \cos^a \phi) L_i \left(\frac{\vec{v} + \vec{l}}{|\vec{v} + \vec{l}|} \right)$$

Diffuse reflection:

$$k_d \cos \theta = \frac{\rho}{\pi} \left(\vec{n} \cdot \vec{l} \right)$$

Specular reflection:

$$k_s \cos^a \phi = k_s z \left(\vec{n} \cdot \frac{\vec{v} + \vec{l}}{|\vec{v} + \vec{l}|} \right)^a$$

$$z = \frac{(a+2)(a+4)}{8\pi(a+2^{-a/2})}$$