

# Raytracer,

Projection de formes 4D  
dans un espace 3D

... sur votre écran 2D.

---

Baché Antoine  
Petrenko Ludovic  
Arnaud Arthur  
Boulagnon Luka

---

27 mai 2016



Projections,

Projections, *ray-casting*,

Projections, *ray-casting*, et *ray-tracing*.

# Sommaire

---

# Sommaire

---

Rendering

Temps réel

Rendu final

Techniquement

# Sommaire

---

Rendering

Temps réel

Rendu final

Techniquement

Formes

PLY

# Sommaire

---

Rendering

Temps réel

Rendu final

Techniquement

Formes

PLY

Effets

# Sommaire

---

Rendering

Temps réel

Rendu final

Techniquement

Formes

PLY

Effets

Images

# Rendering

---

# Rendering & optimisations

---

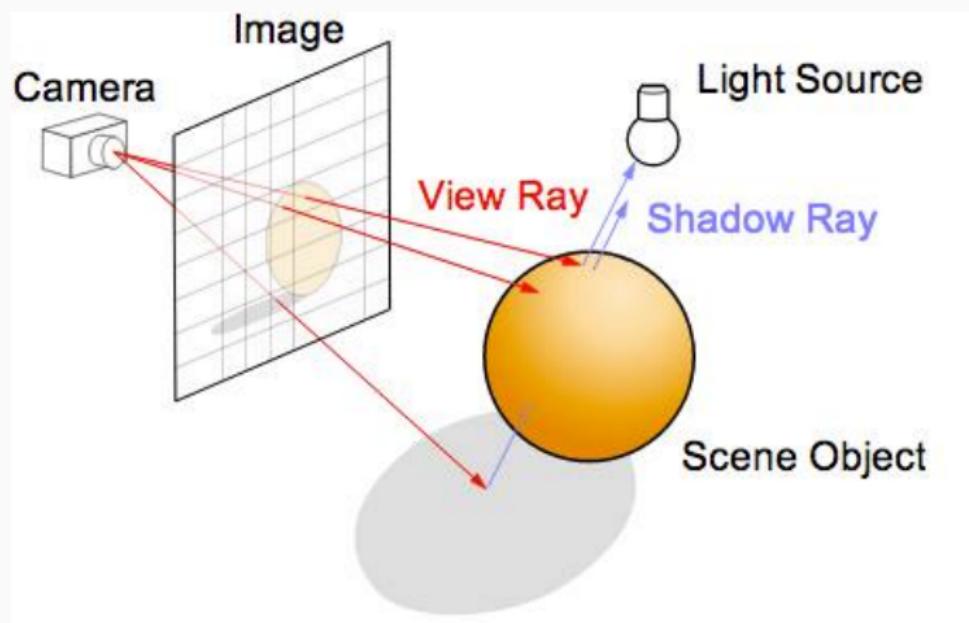
- Système de box pour chaque élément ;

# Rendering & optimisations

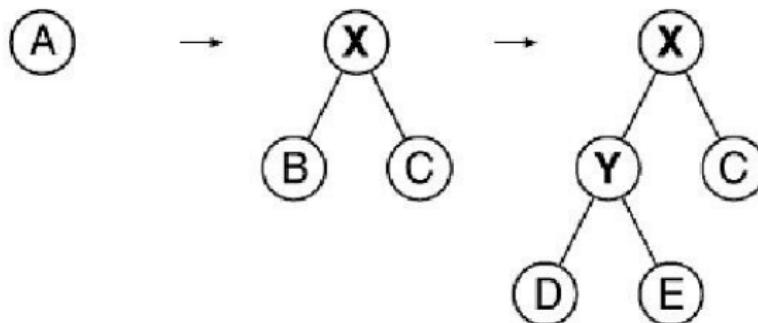
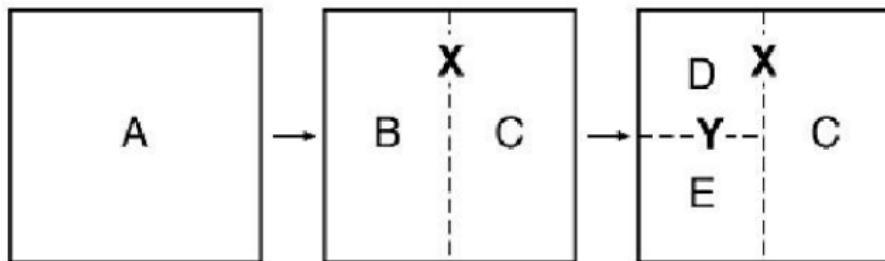
---

- Système de box pour chaque élément ;
- Système de partitionnement de l'espace ;

# Ray-tracing



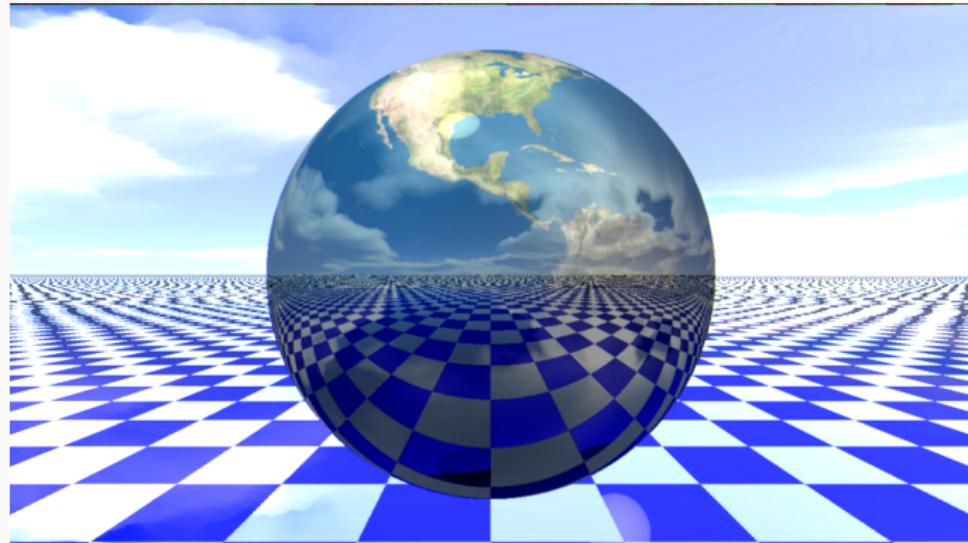
# Ray-tracing



En direct



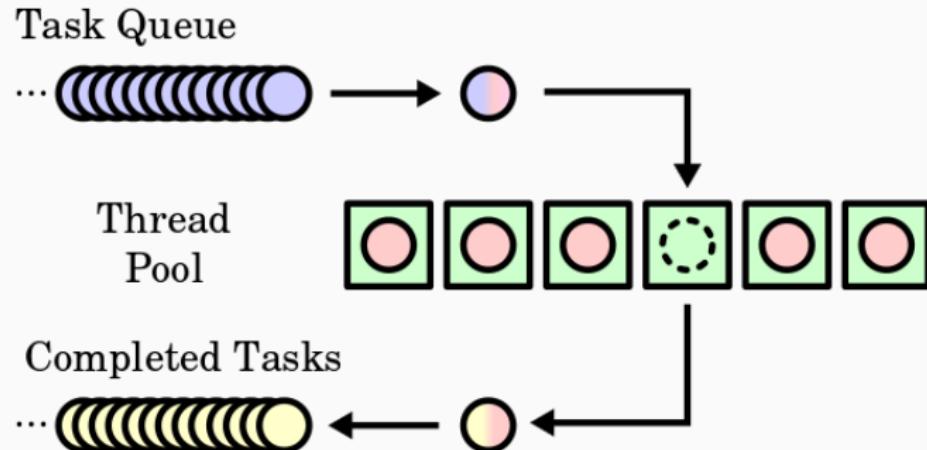
# Rendu final



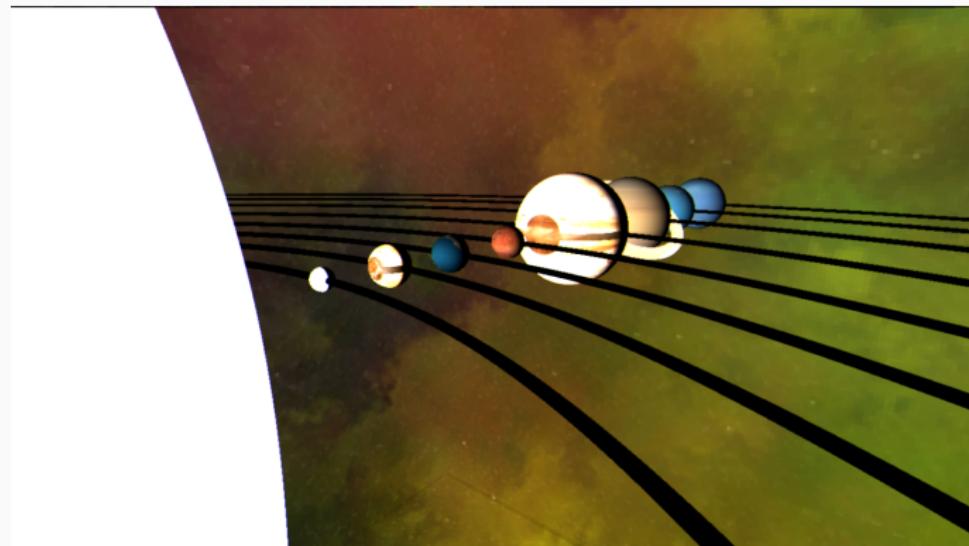
Techniquement

---

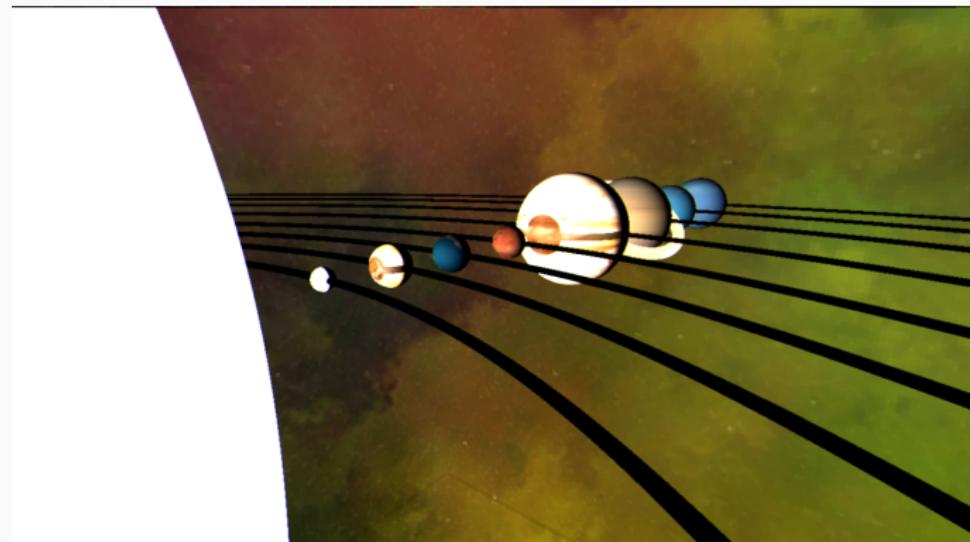
# Thread pool



# Gestion des formes



# Gestion des formes



Tout l'ensemble du code a été pensé « *objet* ».

# Ajout d'une nouvelle forme

Script de factorisation de l'équation des formes en fonction du degré d'équation :

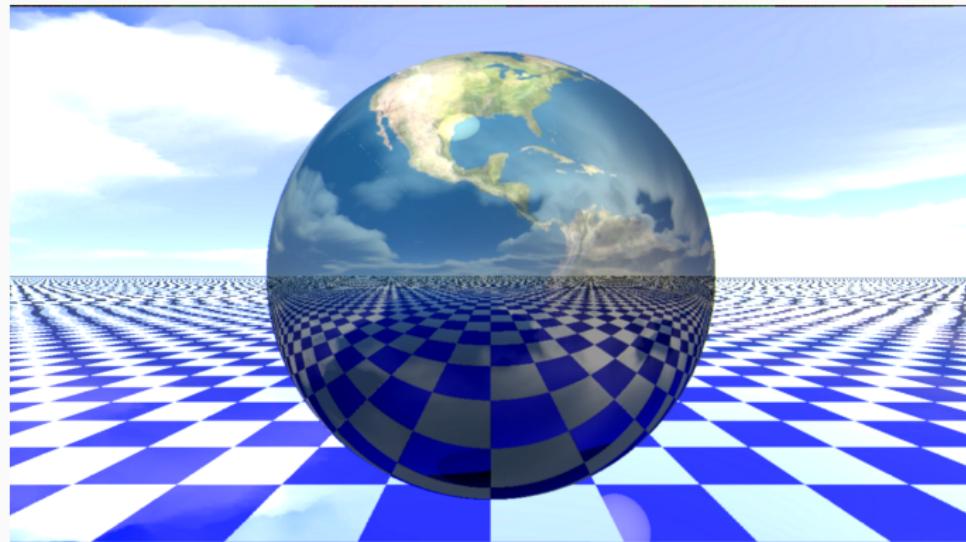
```
=====
- 0.5 × ray->pos.x × ray->pos.x
+ 2.0 × ray->pos.x × ray->pos.x × ray->pos.y × ray->pos.y
+ 0.5 × ray->pos.y × ray->pos.y
+ ray->pos.x × ray->pos.x × ray->pos.x × ray->pos.x
+ ray->pos.y × ray->pos.y × ray->pos.y × ray->pos.y
- ray->pos.z × ray->pos.z × ray->pos.z × ray->pos.z
+ 0.0625
=====
+ t × (4.0 × ray->pos.x × ray->pos.y × ray->pos.y × ray->dir.x
[ 4.0 × ray->pos.x × ray->pos.x × ray->pos.x × ray->dir.x
- ray->pos.x × ray->dir.x
+ 4.0 × ray->pos.y × ray->pos.y × ray->pos.y × ray->dir.y
+ ray->pos.y × ray->dir.y
+ 4.0 × ray->pos.x × ray->pos.x × ray->pos.y × ray->dir.y
- 4.0 × ray->pos.z × ray->pos.z × ray->pos.z × ray->dir.z)
=====
+ t × t × (6.0 × ray->pos.x × ray->pos.x × ray->dir.x × ray->dir.x
+ 2.0 × ray->pos.y × ray->pos.y × ray->dir.x × ray->dir.x
- 0.5 × ray->dir.x × ray->dir.x
+ 2.0 × ray->pos.x × ray->pos.x × ray->dir.y × ray->dir.y
+ 6.0 × ray->pos.y × ray->pos.y × ray->dir.y × ray->dir.y
+ 0.5 × ray->dir.y × ray->dir.y
- 6.0 × ray->pos.z × ray->pos.z × ray->dir.z × ray->dir.z
+ 8.0 × ray->pos.x × ray->pos.y × ray->dir.x × ray->dir.y)
=====
+ t × t × t × (4.0 × ray->pos.x × ray->dir.x × ray->dir.y × ray->dir.y
+ 4.0 × ray->pos.x × ray->dir.x × ray->dir.x × ray->dir.x
+ 4.0 × ray->pos.y × ray->dir.y × ray->dir.y × ray->dir.y
- 4.0 × ray->pos.z × ray->dir.z × ray->dir.z × ray->dir.z
+ 4.0 × ray->pos.y × ray->dir.x × ray->dir.x × ray->dir.y)
=====
+ t × t × t × t × (2.0 × ray->dir.x × ray->dir.x × ray->dir.y × ray->dir.y
+ ray->dir.x × ray->dir.y × ray->dir.x × ray->dir.x
+ ray->dir.y × ray->dir.y × ray->dir.y × ray->dir.y
| - ray->dir.z × ray->dir.z × ray->dir.z × ray->dir.z)
```

## Formes

---

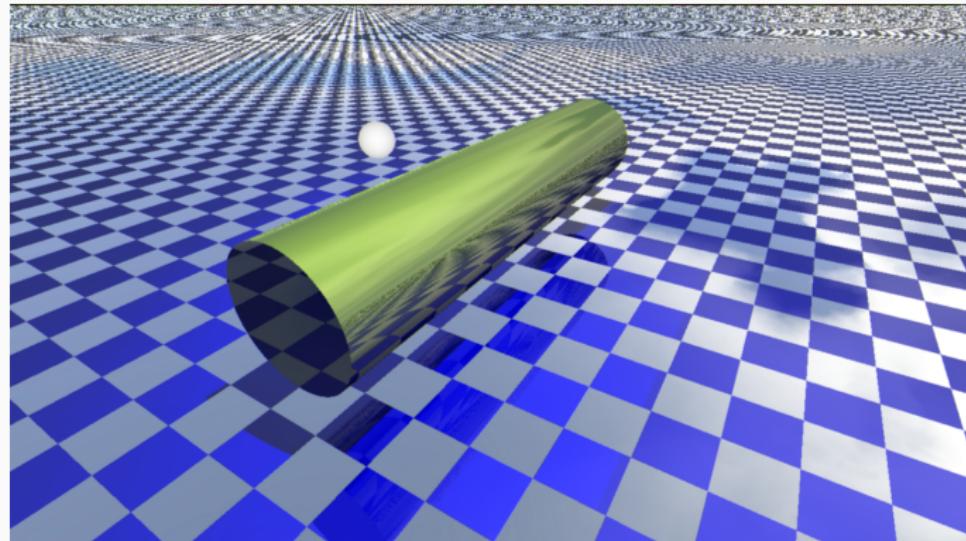
# Liste des formes

Sphère & plan :



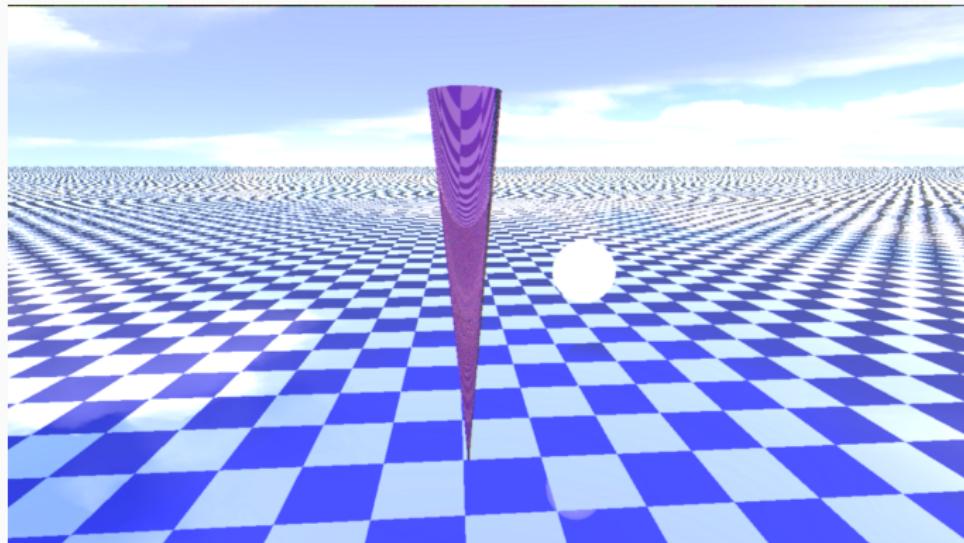
# Liste des formes

Cylindre :



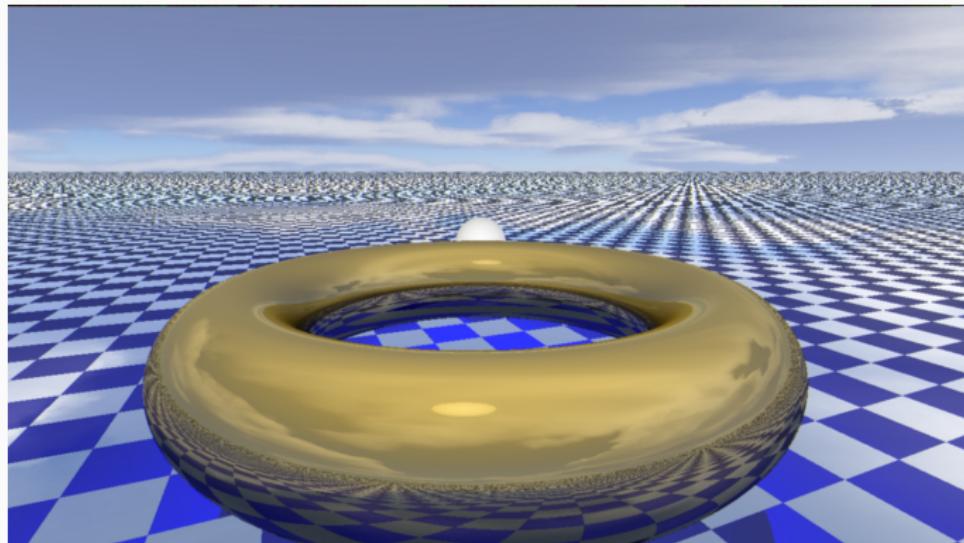
# Liste des formes

Cône :



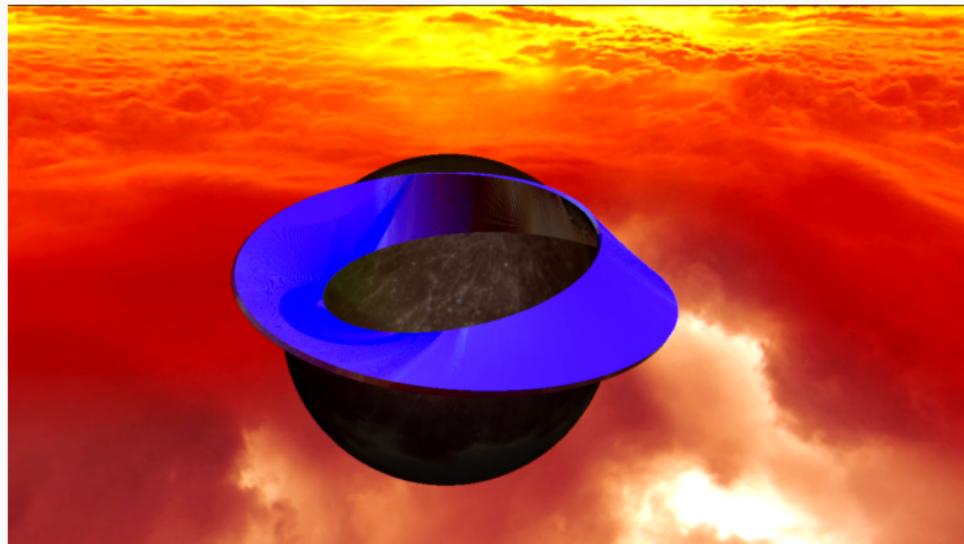
# Liste des formes

Tore :



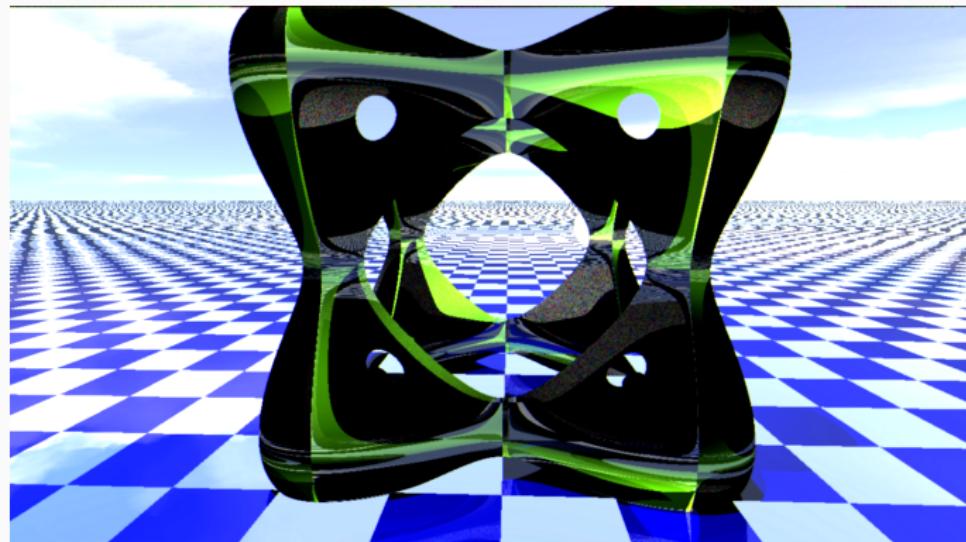
# Liste des formes

Moëbius :



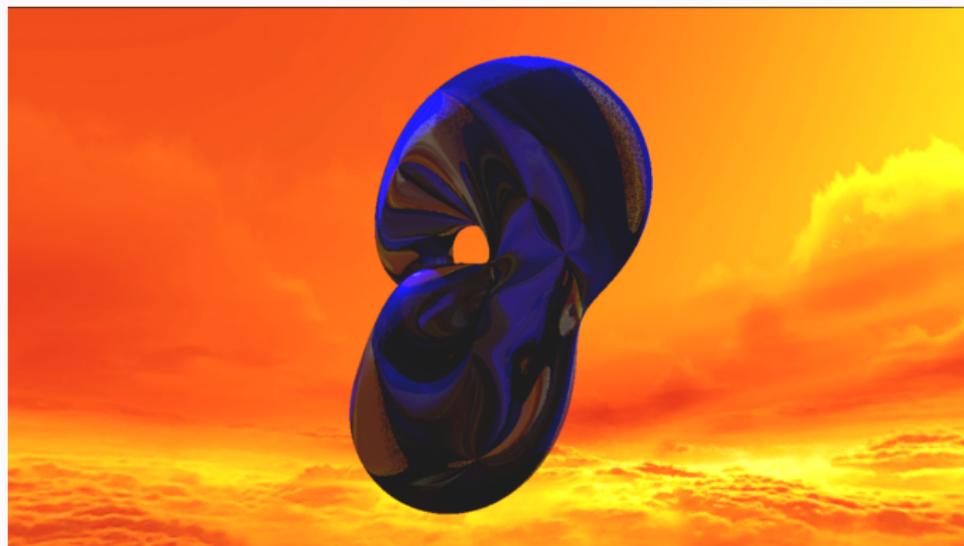
# Liste des formes

*Void Cube :*



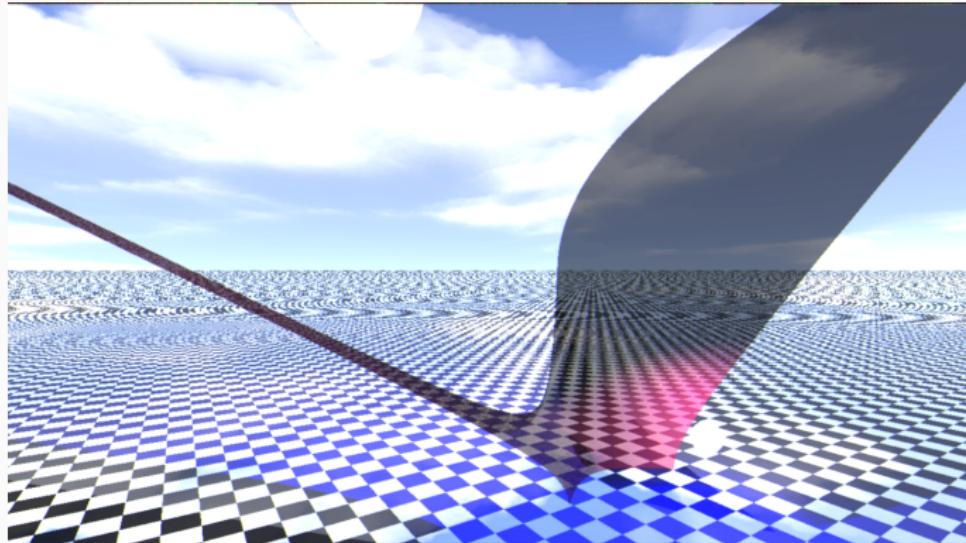
# Liste des formes

Bouteille de Klein :



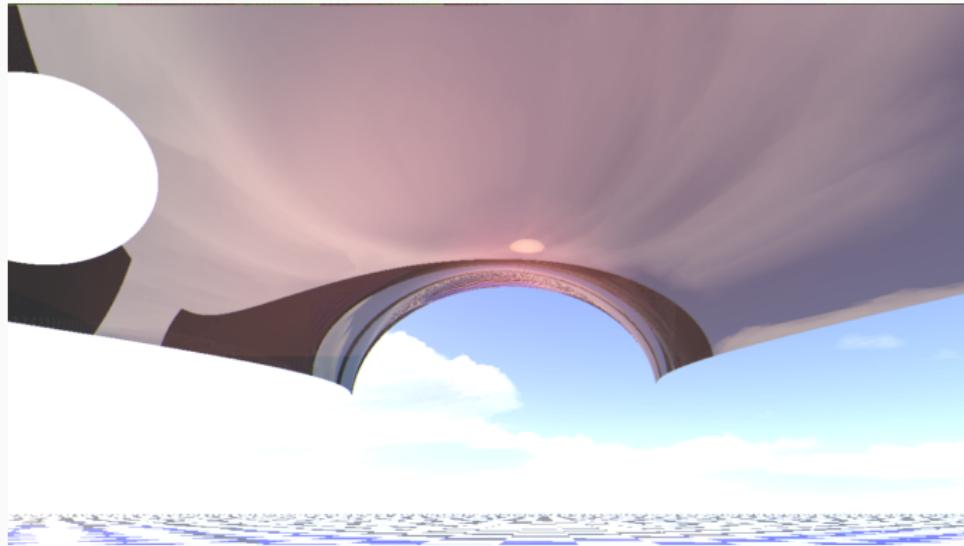
# Liste des formes

*Hyperbola :*



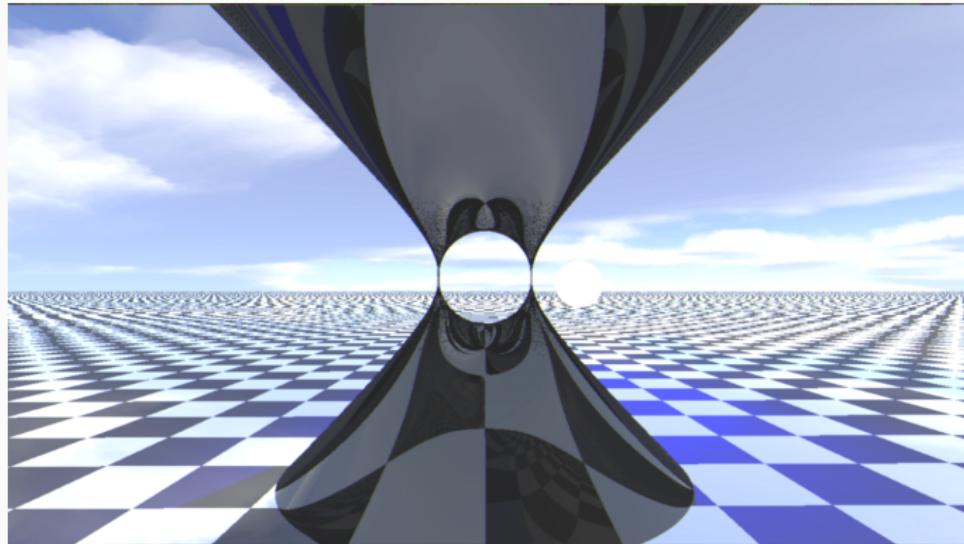
# Liste des formes

Ellipsoïde :



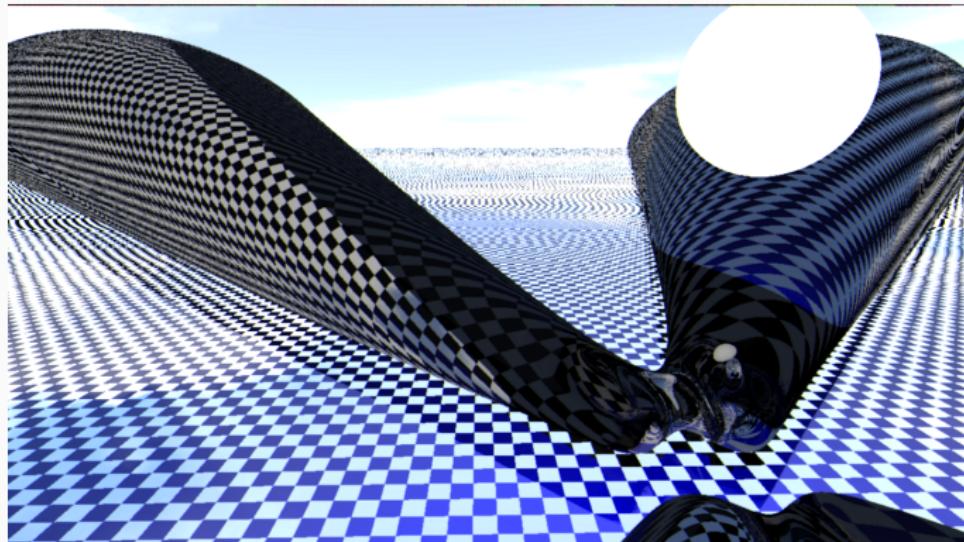
# Liste des formes

Ovale de Cassini :



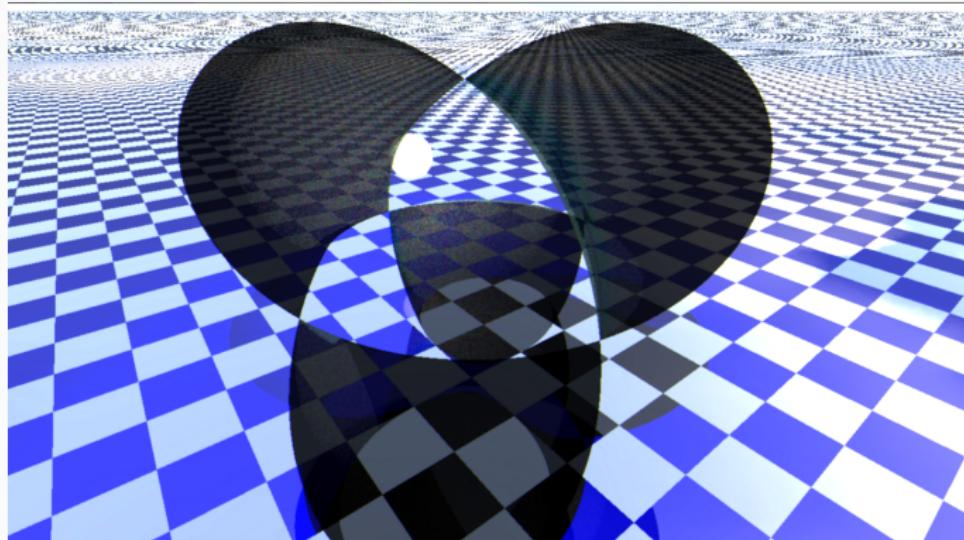
# Liste des formes

*Chair :*



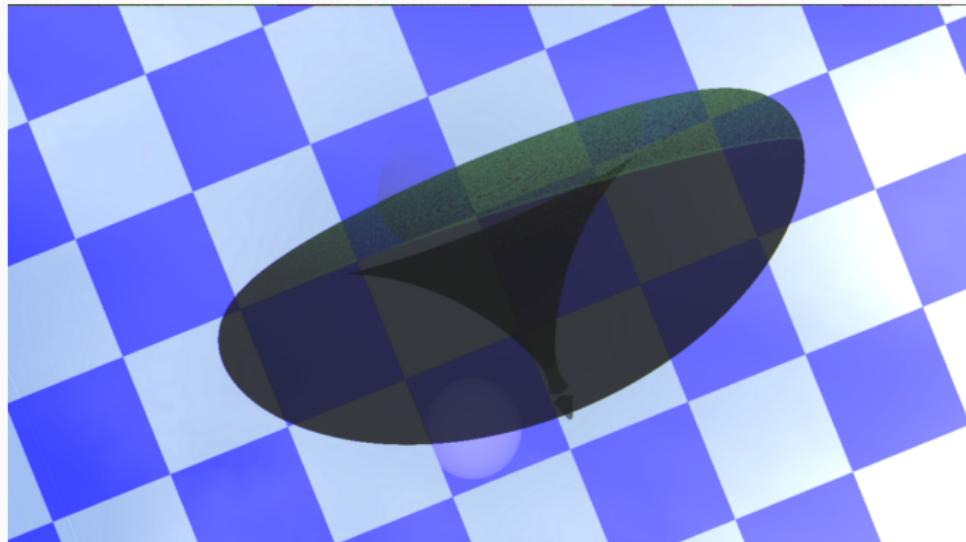
# Liste des formes

*Tetrahedral :*



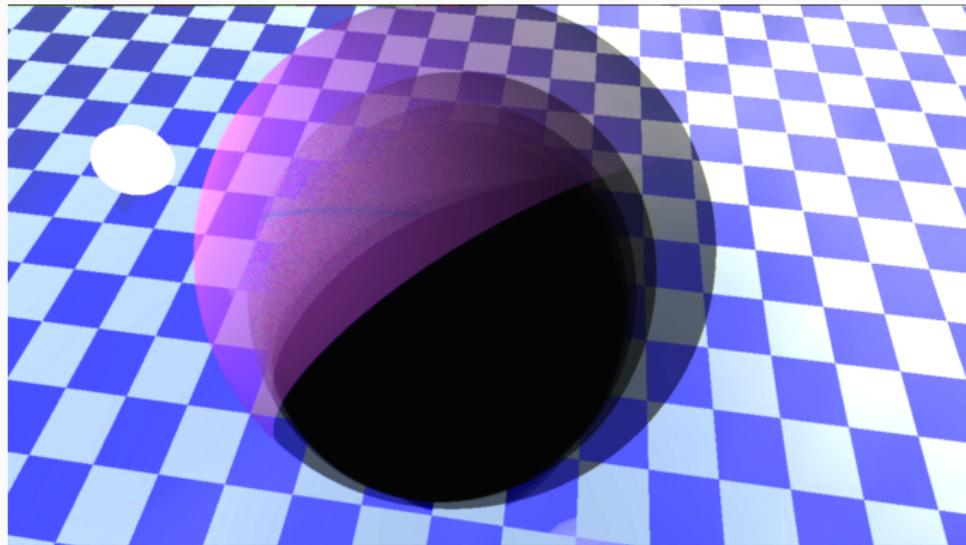
# Liste des formes

*Bifolia* :



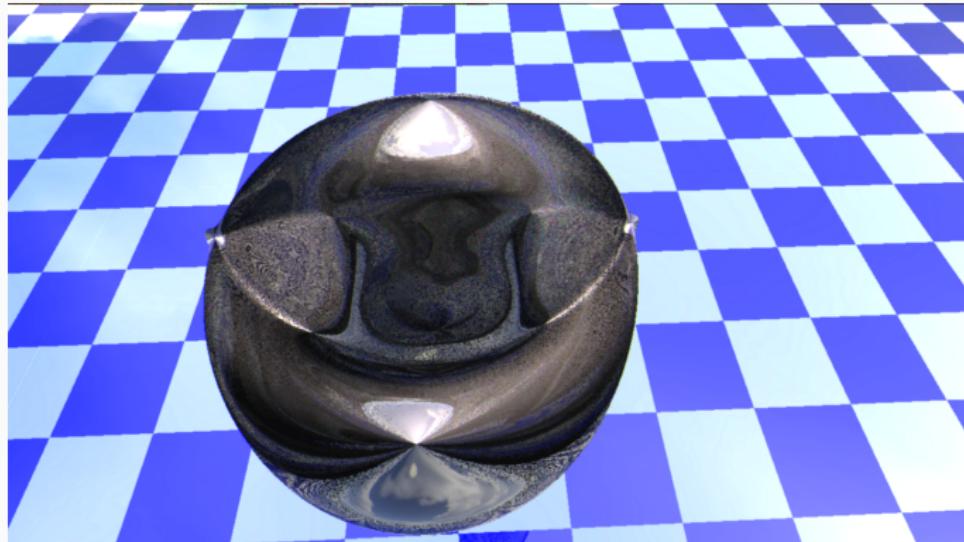
# Liste des formes

*Duplin :*



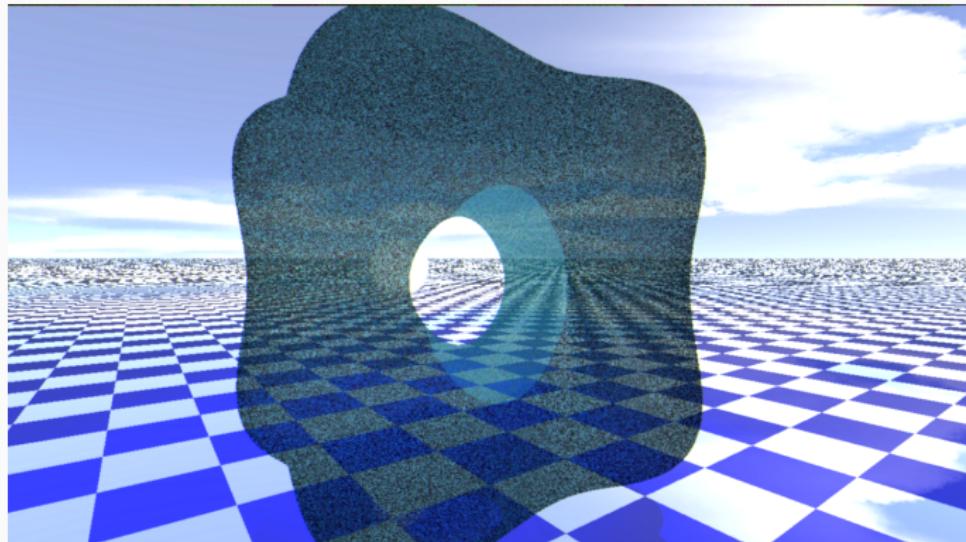
# Liste des formes

*Cushion :*



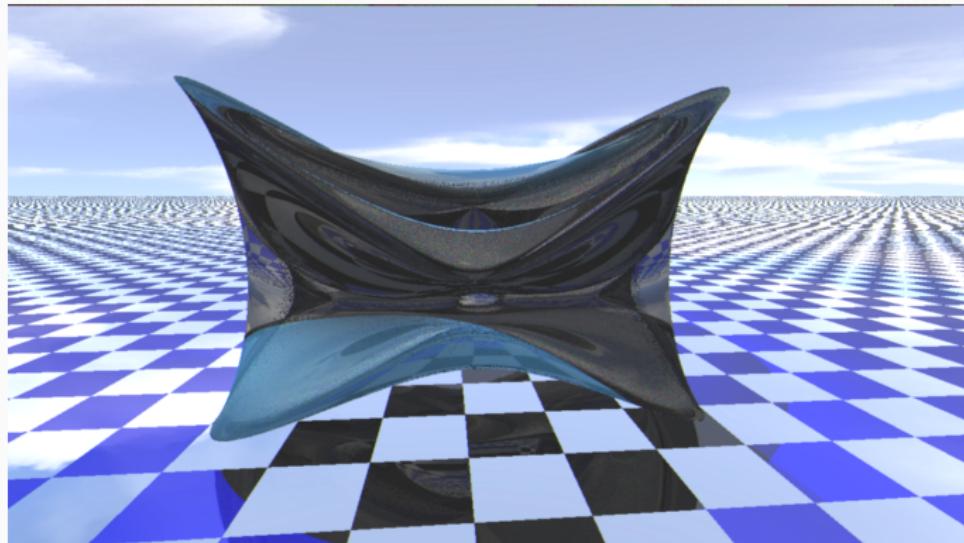
# Liste des formes

*Tooth :*



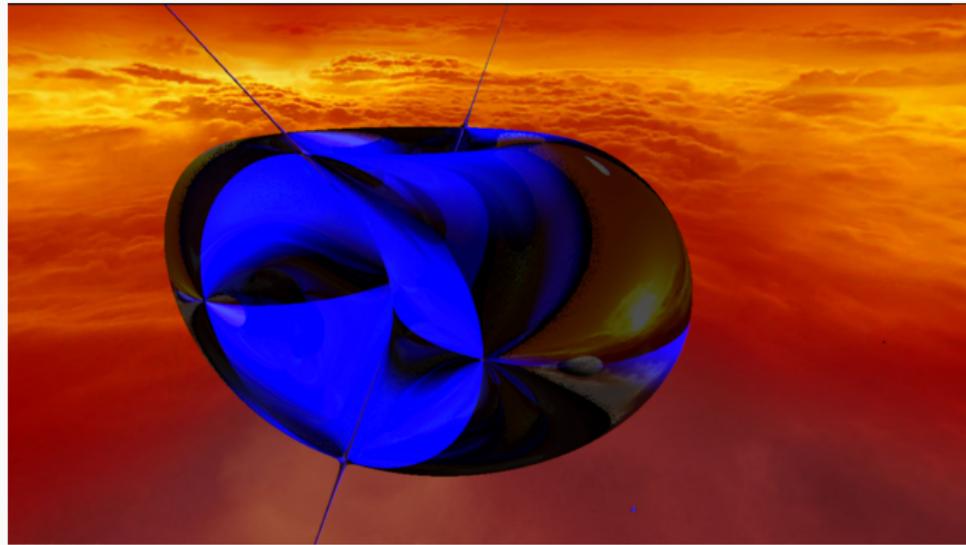
# Liste des formes

*Hunt :*



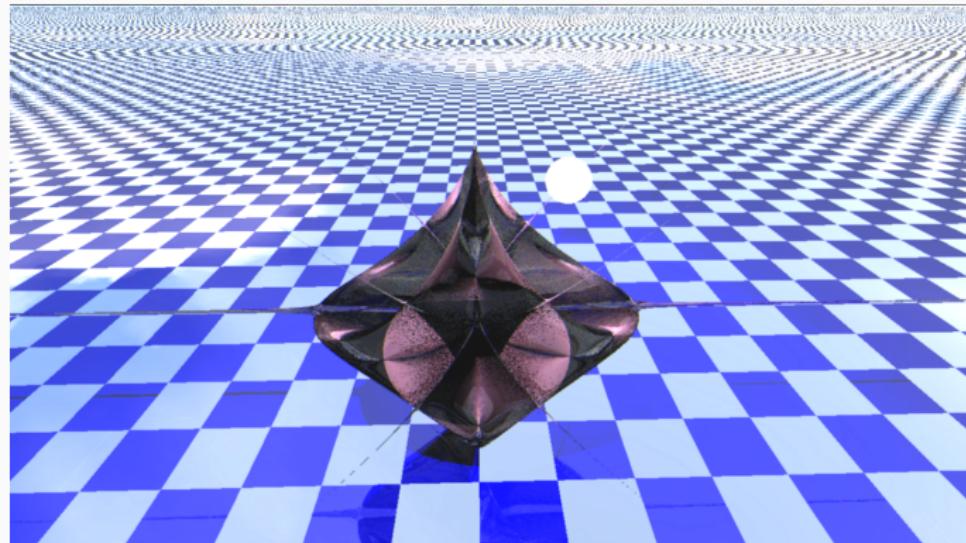
# Liste des formes

*Bohemian Dome :*



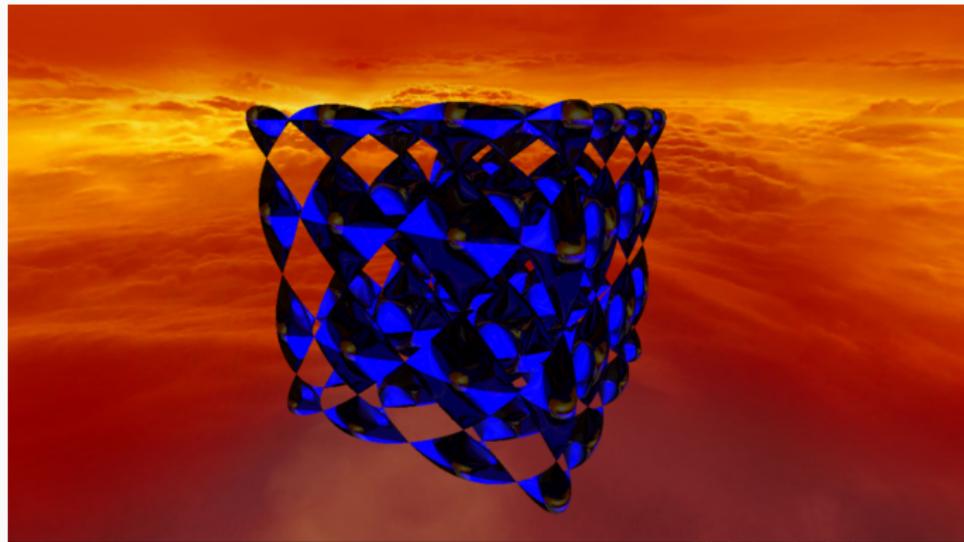
# Liste des formes

*Bohemian Star :*



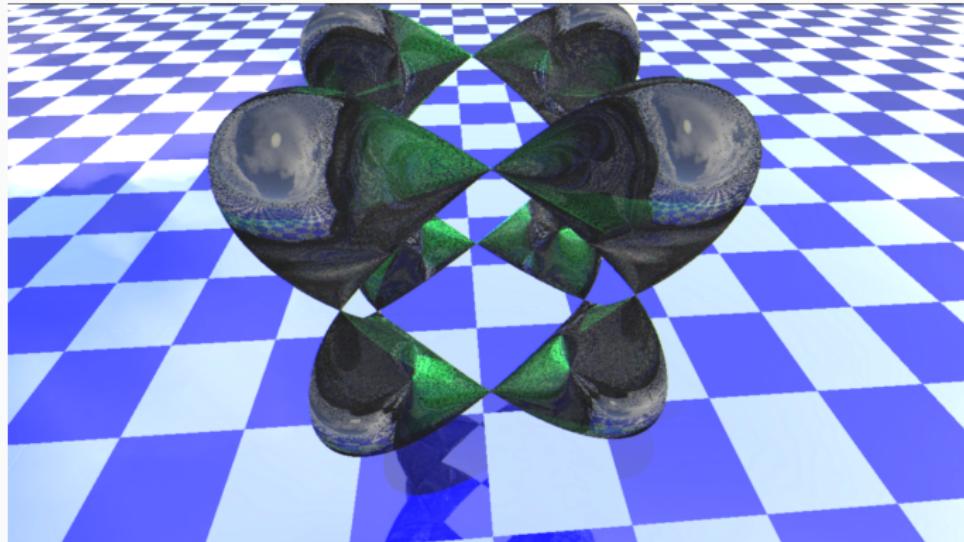
# Liste des formes

*C8 :*



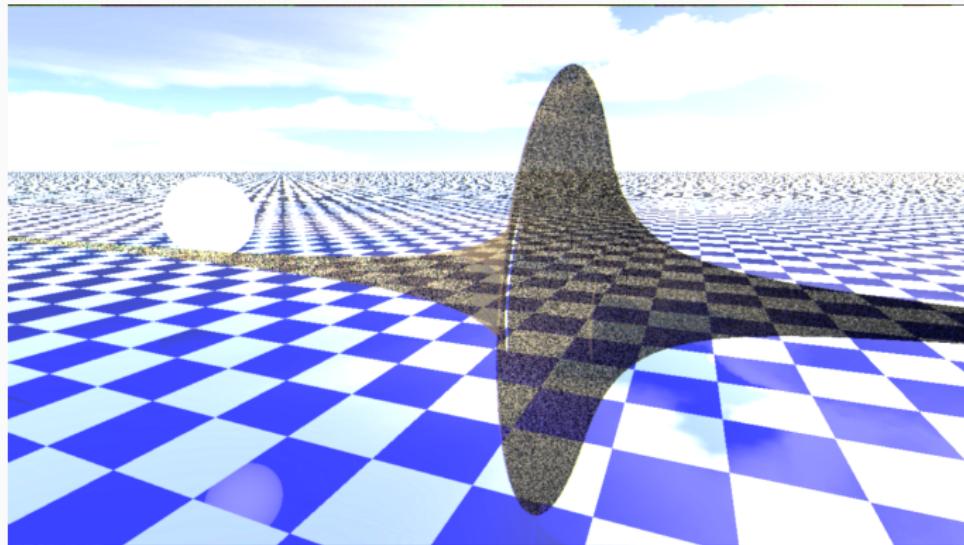
# Liste des formes

*Chubs :*



# Liste des formes

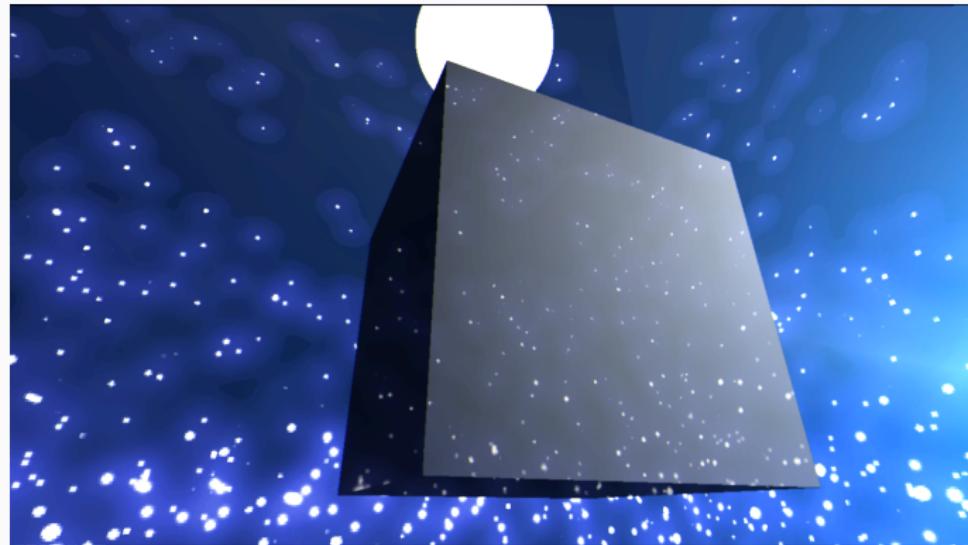
*Quartic Cylinder :*



# Liste des formes

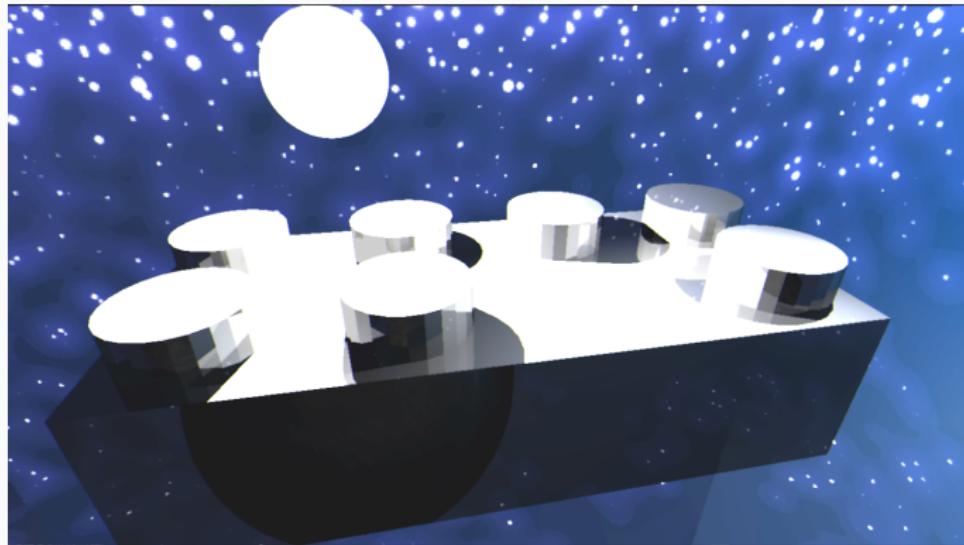
---

PLY :



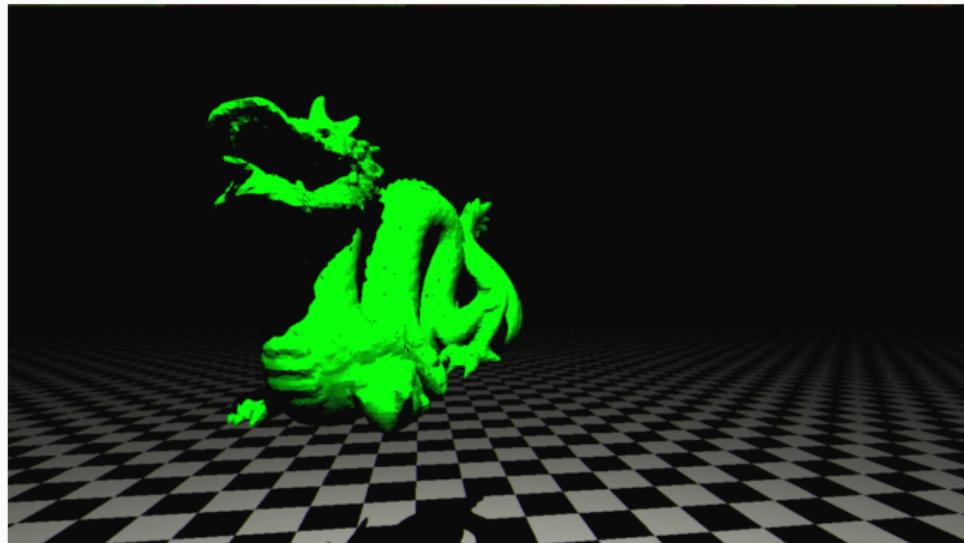
# Liste des formes

PLY :



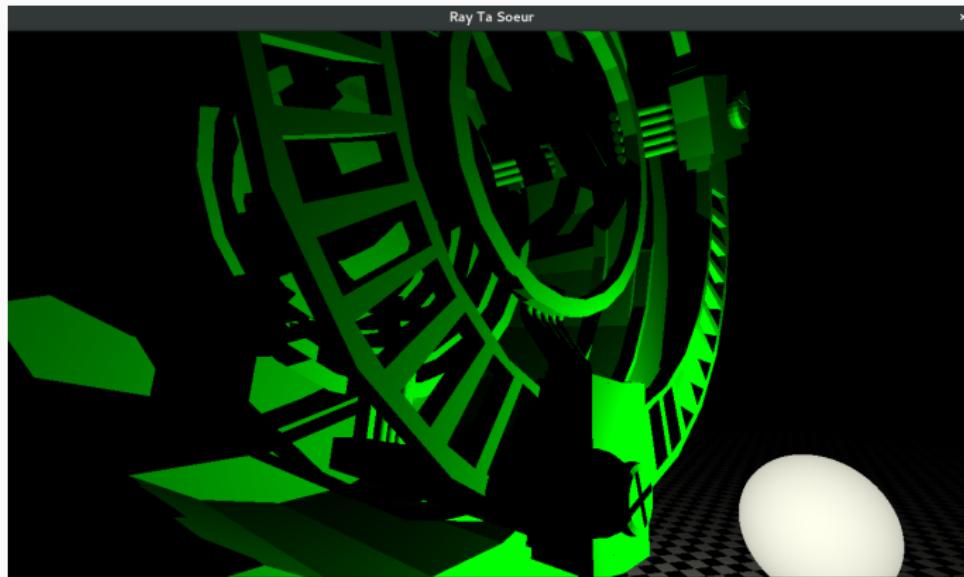
# Liste des formes

PLY :



# Liste des formes

PLY :



# Gestion des PLY

```
ply

format ascii 1.0
format binary_little_endian 1.0
format binary_big_endian 1.0

element vertex 12
property float x
property float y
property float z

element face 10
property list uchar int vertex_indices

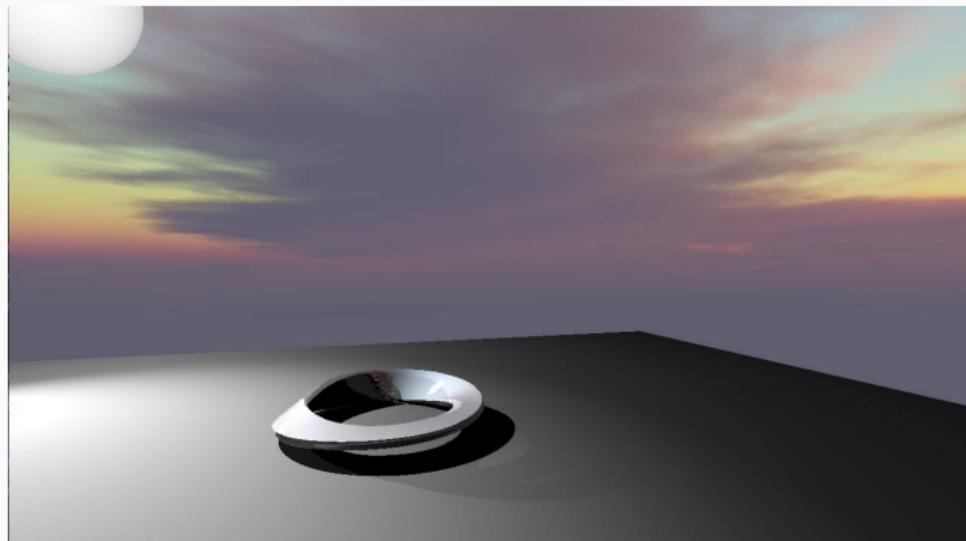
end header
```

# Gestion des PLY

```
0 0 0  
0 0 1  
0 1 1  
0 1 0  
1 0 0  
1 0 1  
1 1 1  
1 1 0  
4 0 1 2 3  
4 7 6 5 4  
4 0 4 5 1  
4 1 5 6 2  
4 2 6 7 3
```

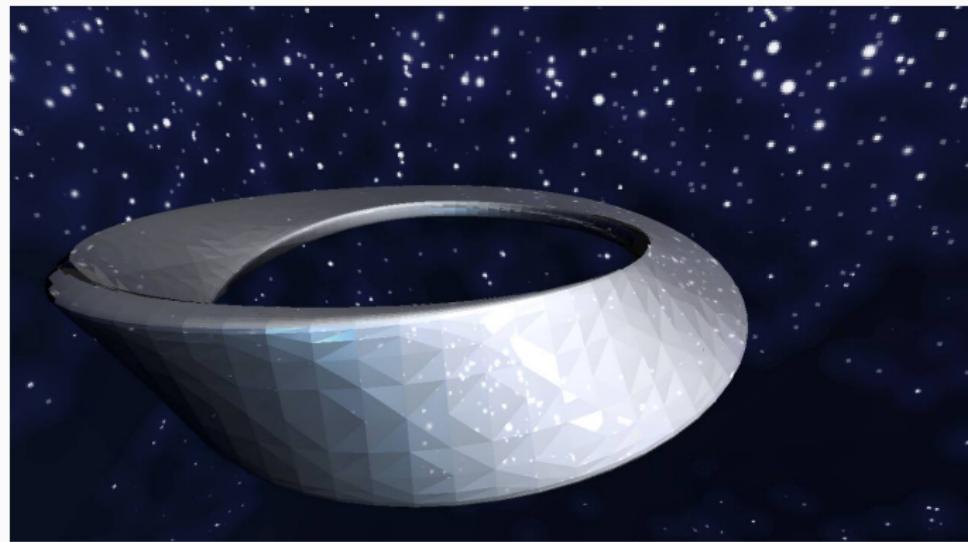


# Puissance des PLY



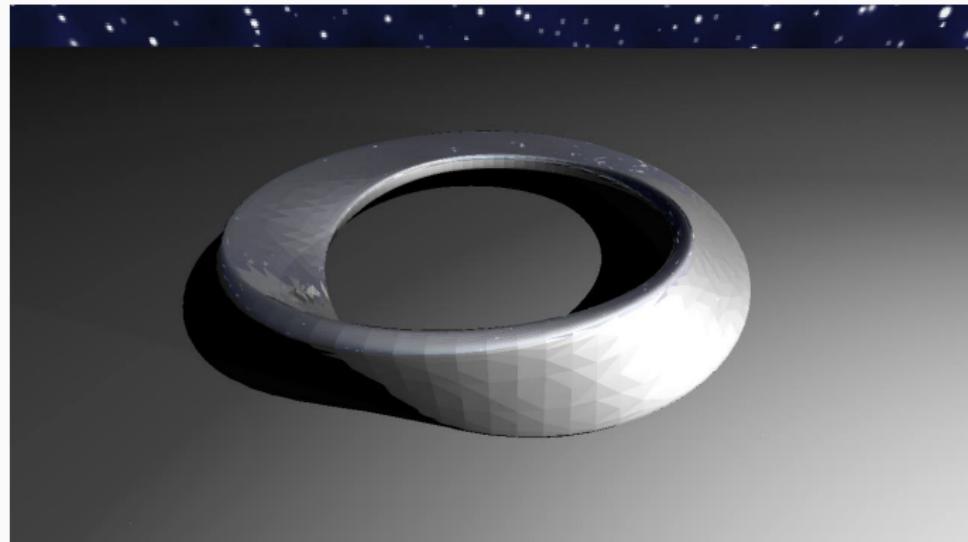
# Puissance des PLY

---

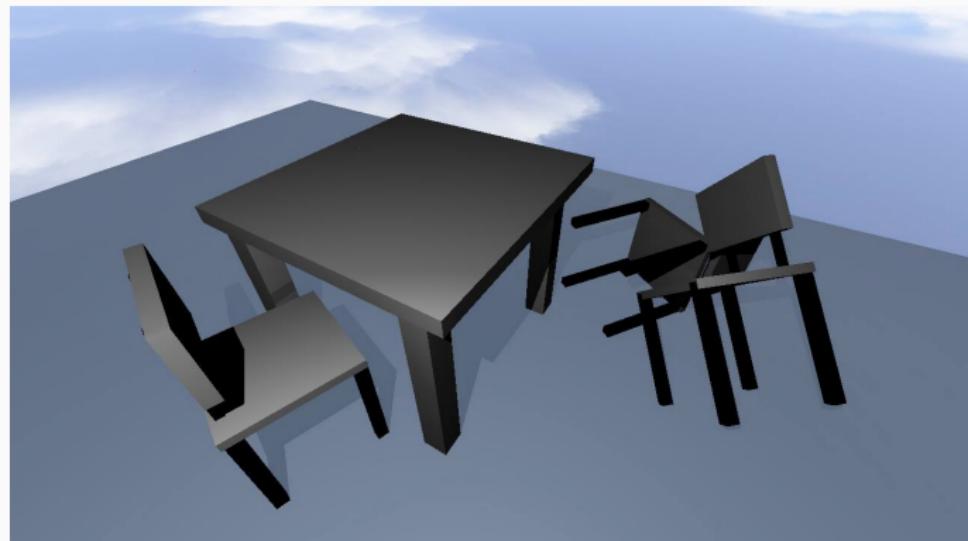


# Puissance des PLY

---



# Puissance des PLY



# Puissance des PLY



## Effets

---

# Effets

---

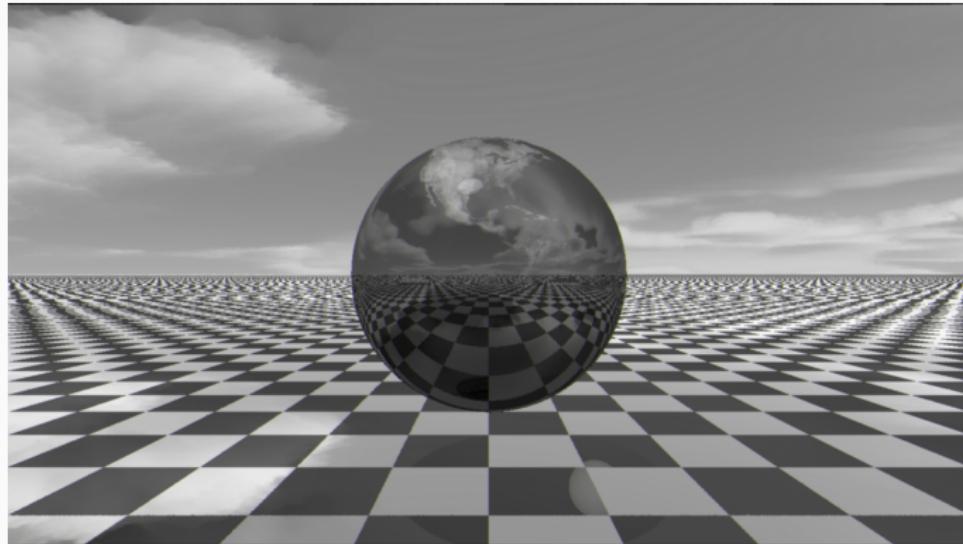
# Effets

---

Les effets sont appliqués sur le rendu final complet, selon différents algorithmes.

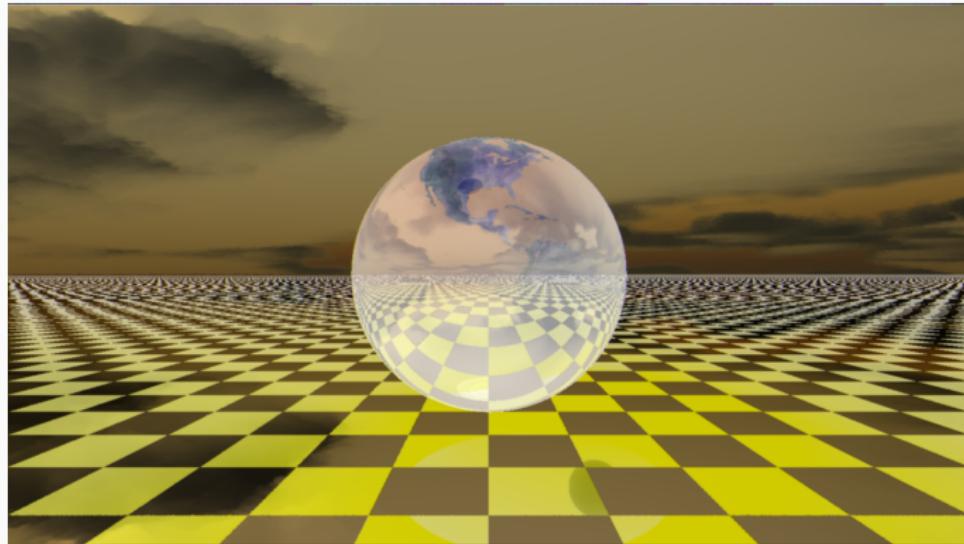
# Effets

Les effets sont appliqués sur le rendu final complet, selon différents algorithmes.



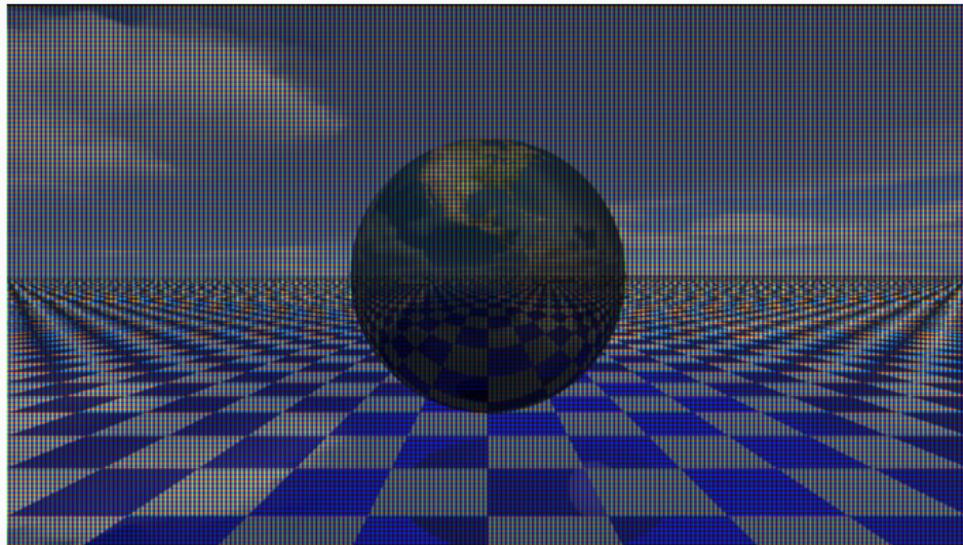
# Effets

Les effets sont appliqués sur le rendu final complet, selon différents algorithmes.



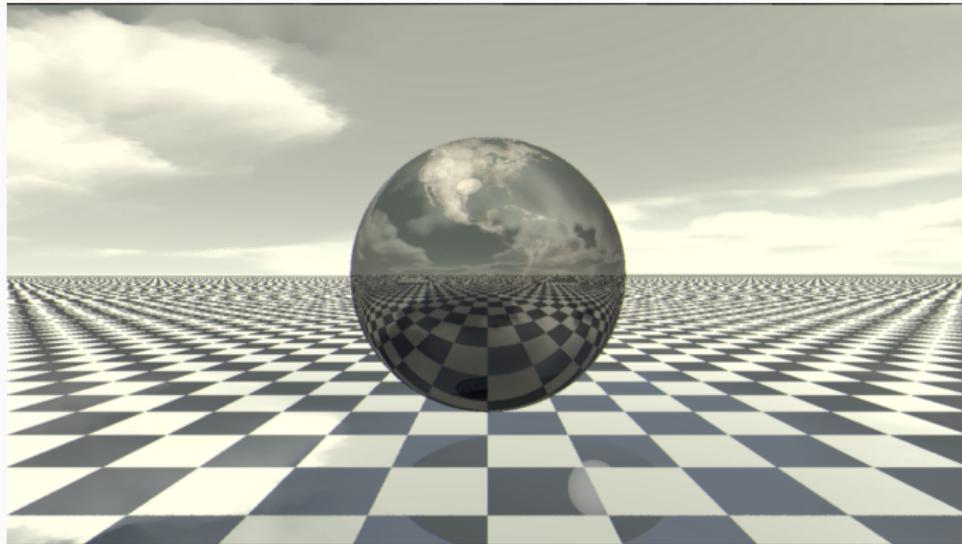
# Effets

Les effets sont appliqués sur le rendu final complet, selon différents algorithmes.



# Effets

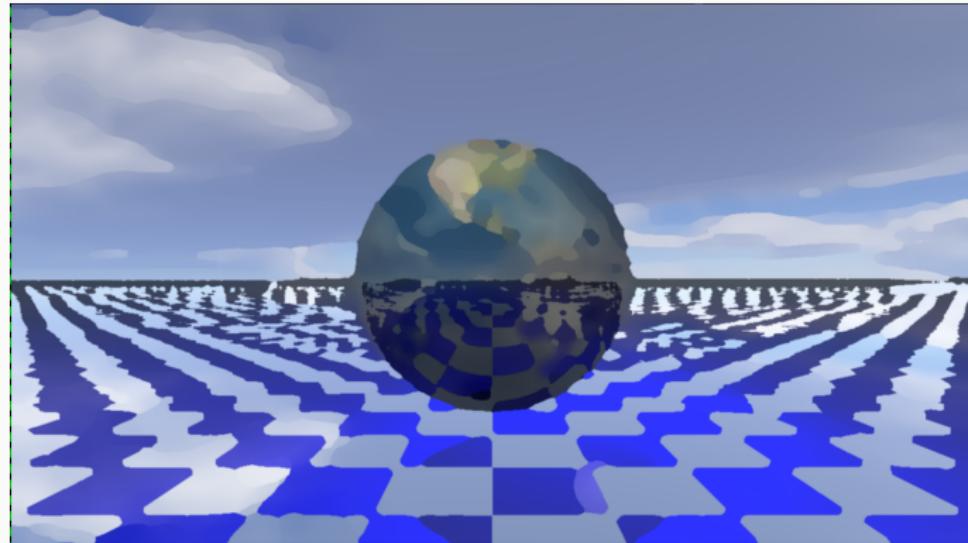
Les effets sont appliqués sur le rendu final complet, selon différents algorithmes.



## Images

---

Un futur... ?



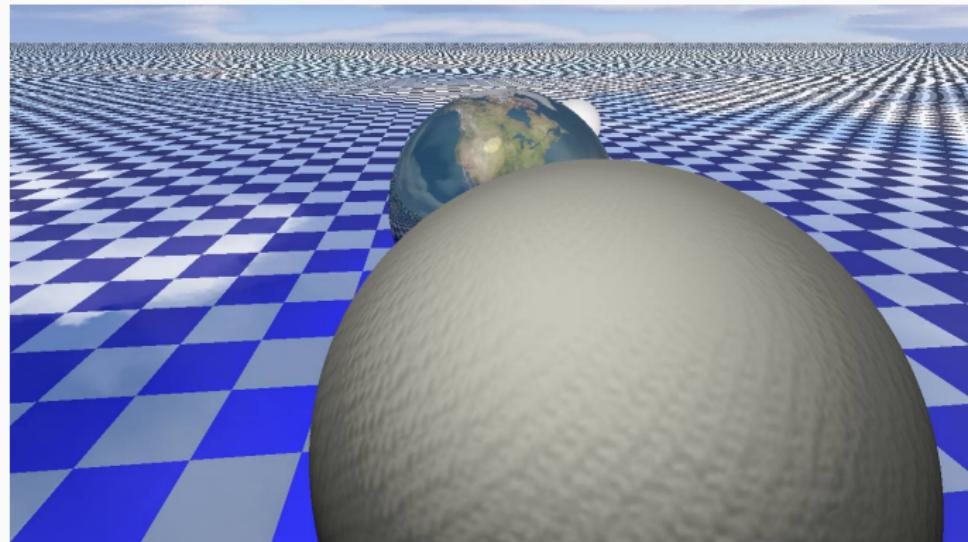
Un futur... ?



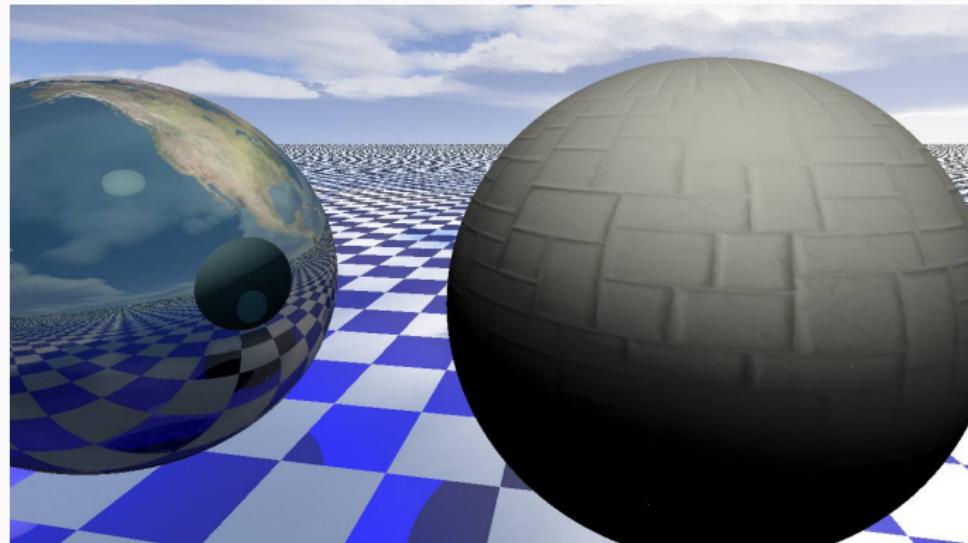
Un futur... ?



Un futur... ?



Un futur... ?



# Questions

Merci de votre attention