

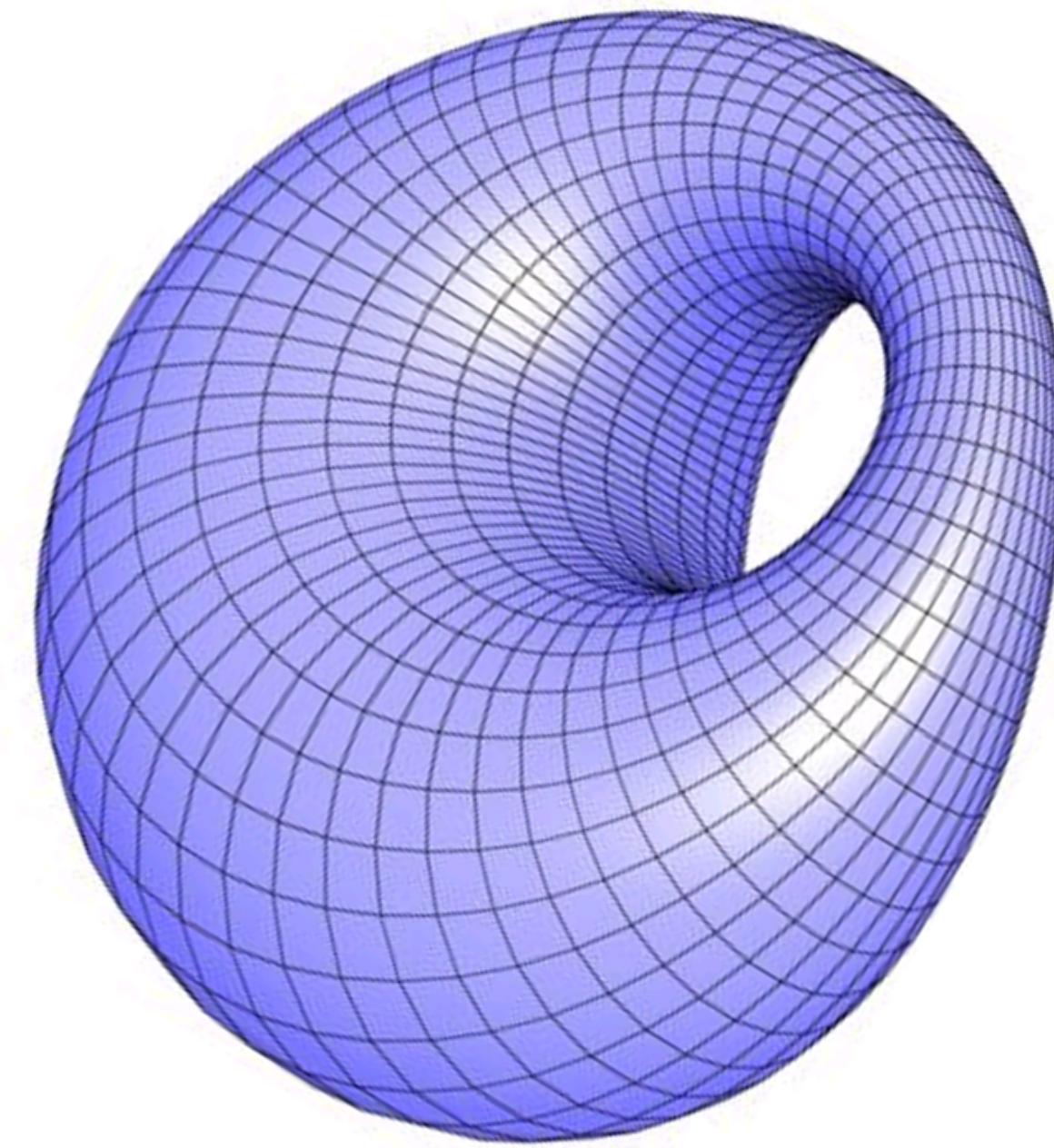
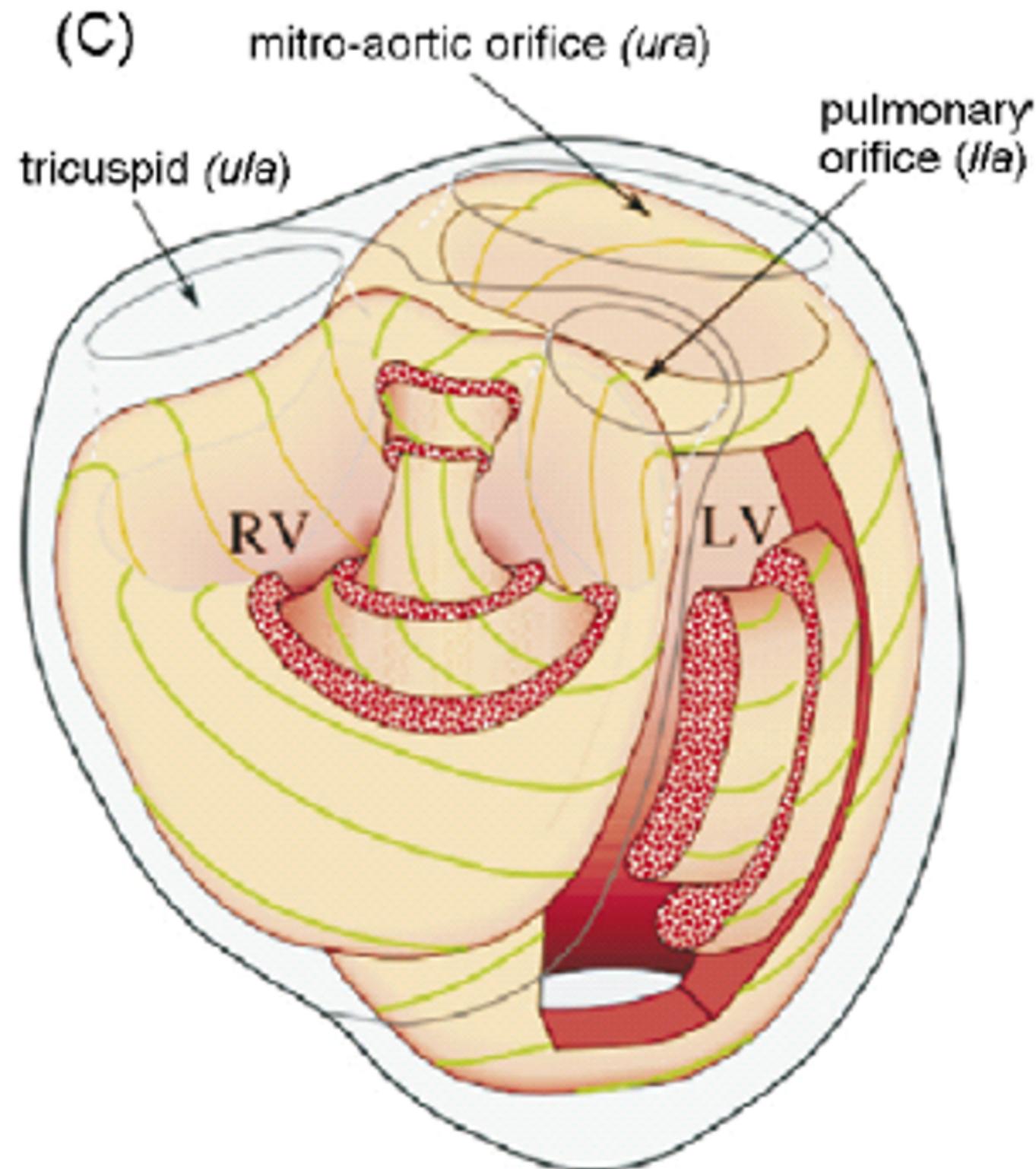
# Les géodésiques d'un pneu qui se déforme

*DYCTIM<sup>2</sup> le 18 février 2015 – Pierre-Simon Jouk*

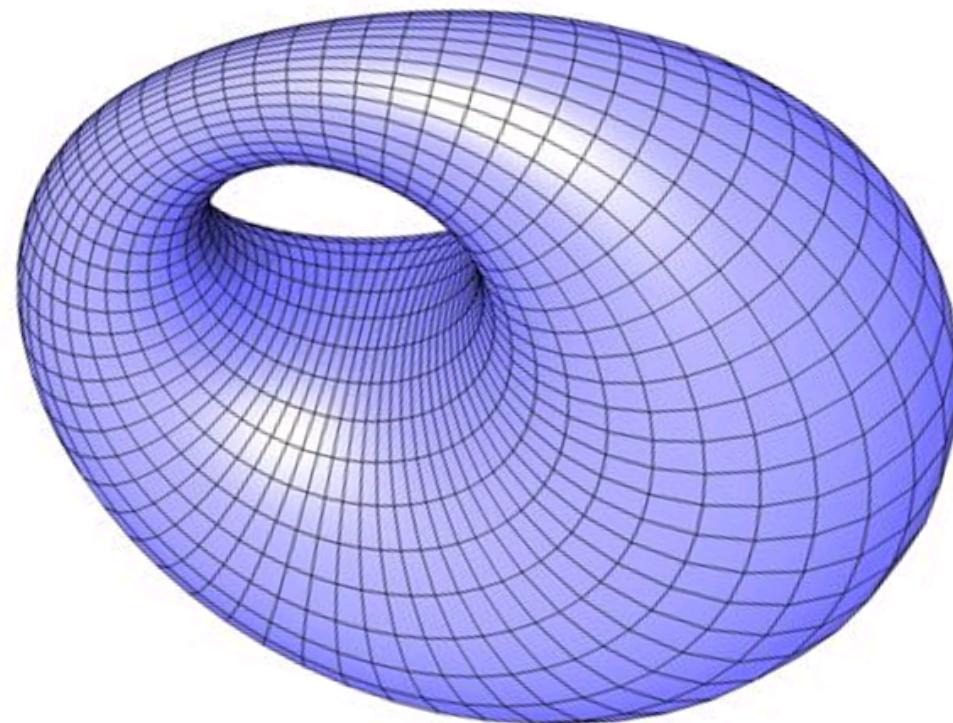
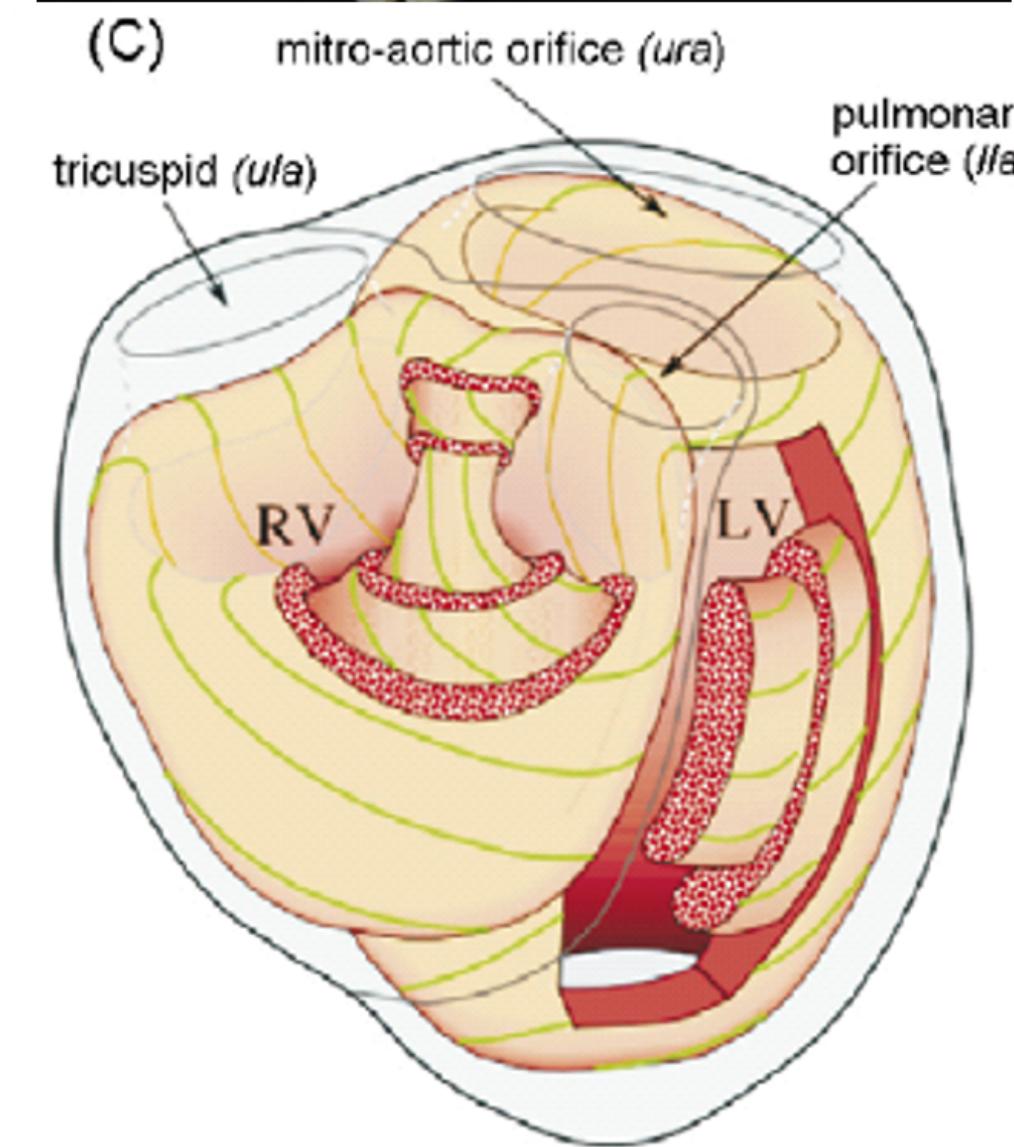
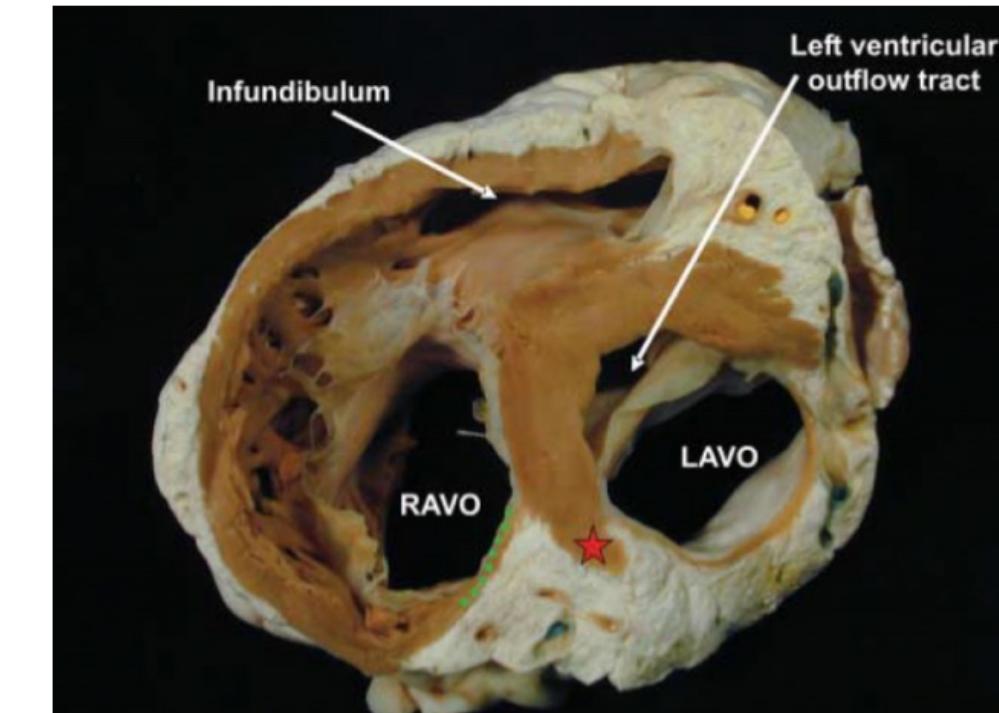
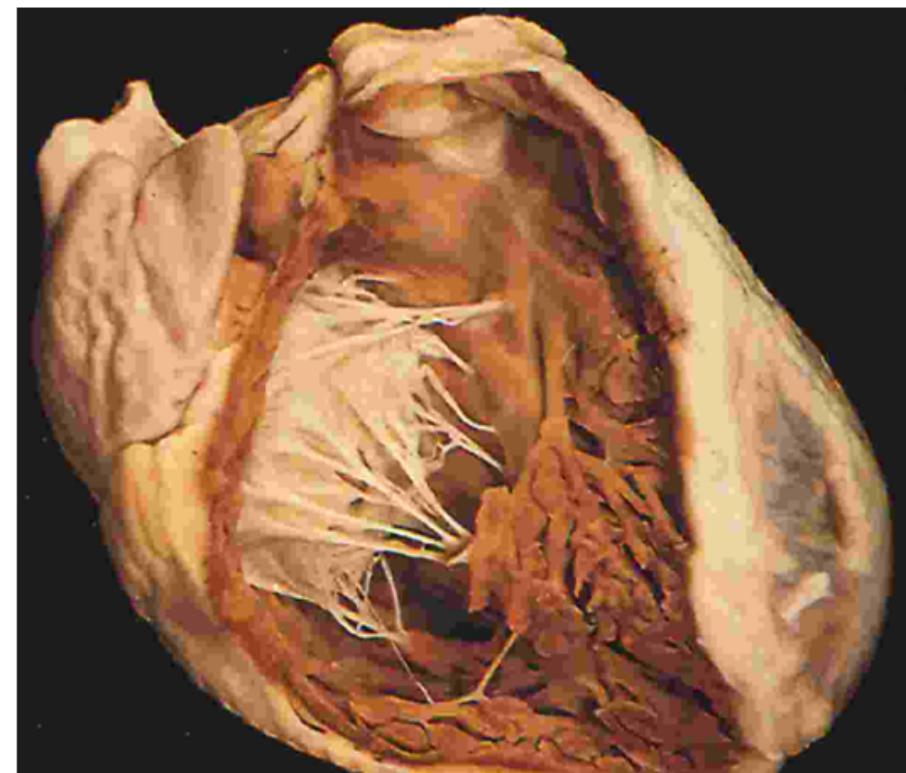
*NDLR : Il n'y a pas de fibres dans le cœur, mais des directions préférentielles des cellules myocardiques des trajectoires non orientées*



# Cyclide De Dupin



# Cyclide De Dupin



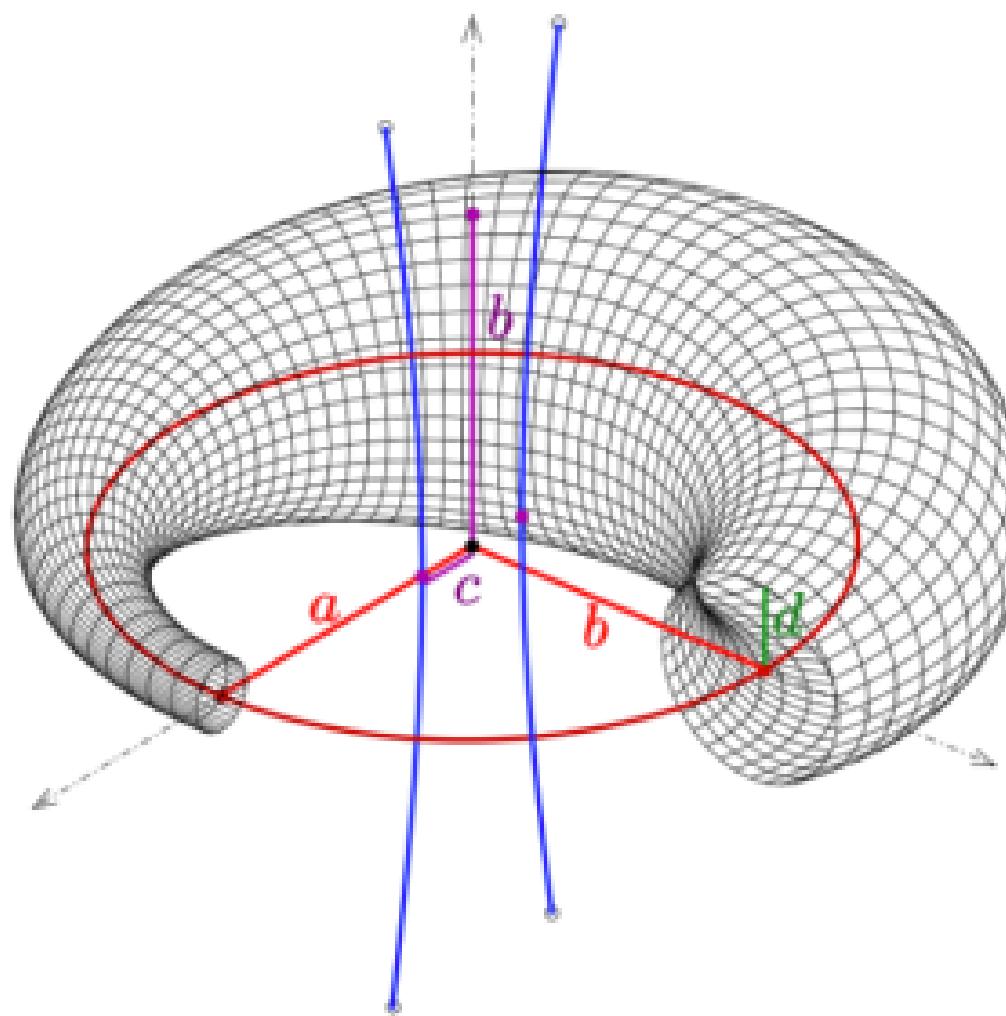
# Cyclide De Dupin



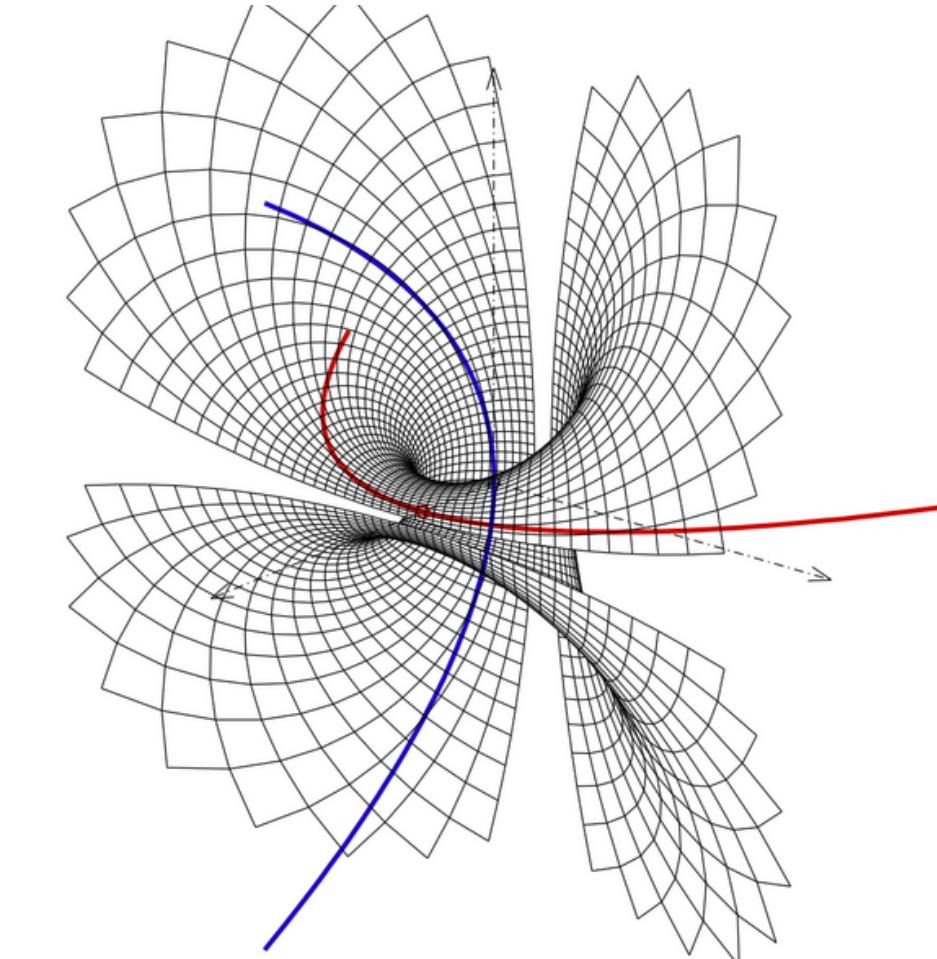
*Les coniques focales sont une ellipse et une hyperbole*



*Les Coniques focales sont 2 paraboles*

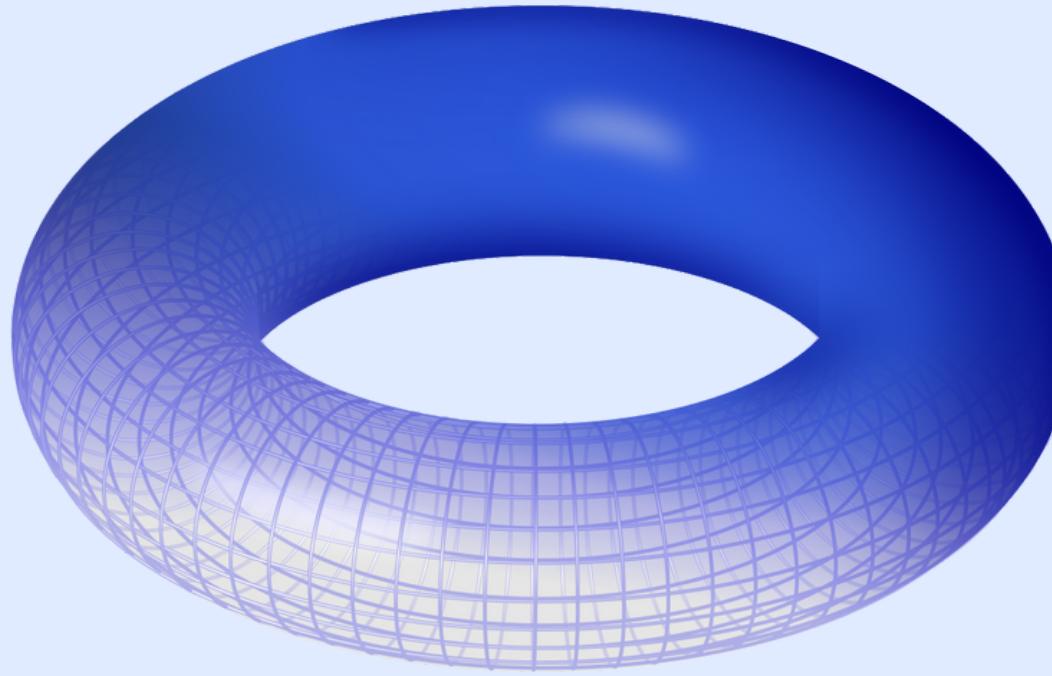


**Cyclide ellipto-hyperbolique**

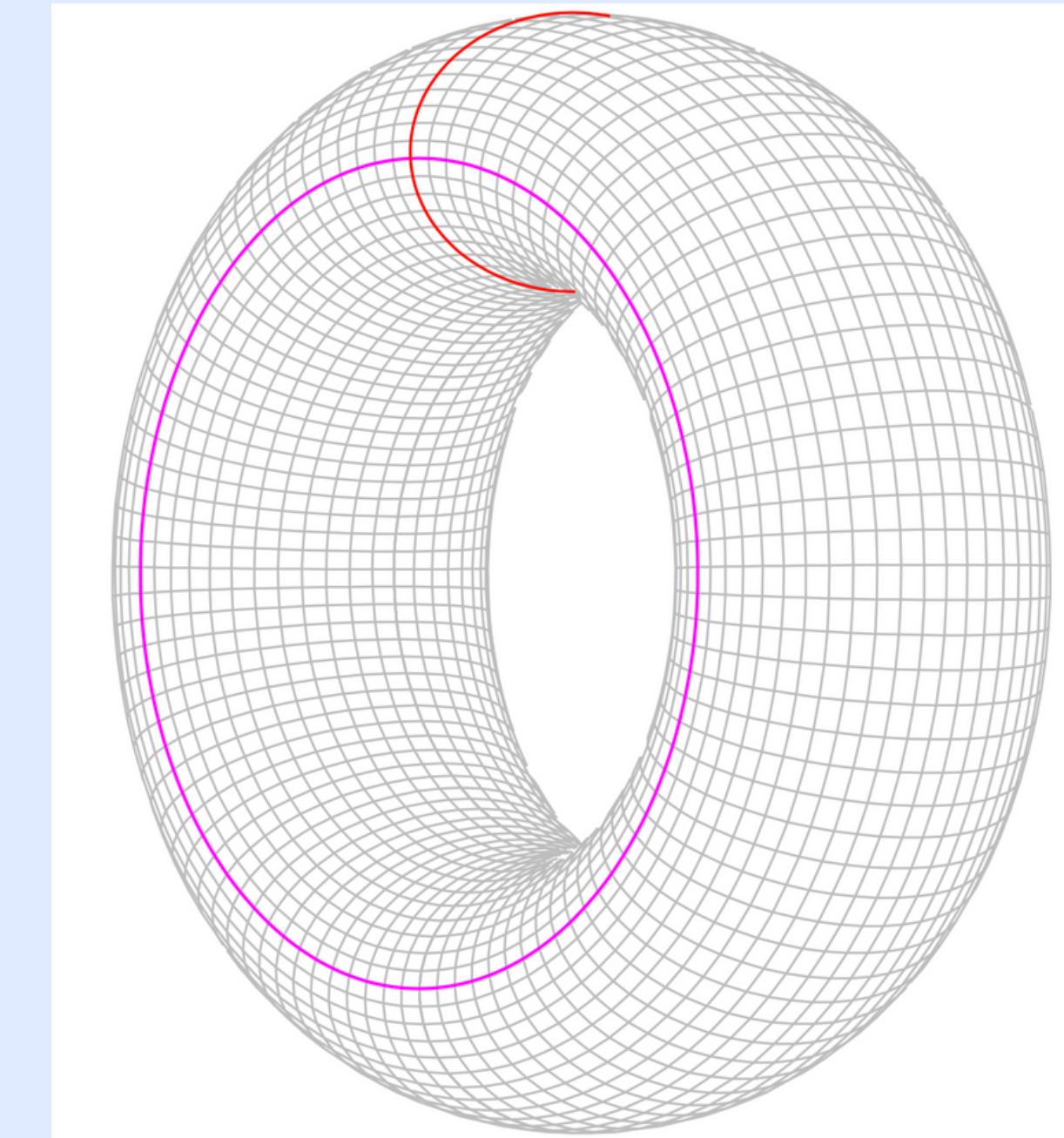


**Cyclide parabolique**

# Tore

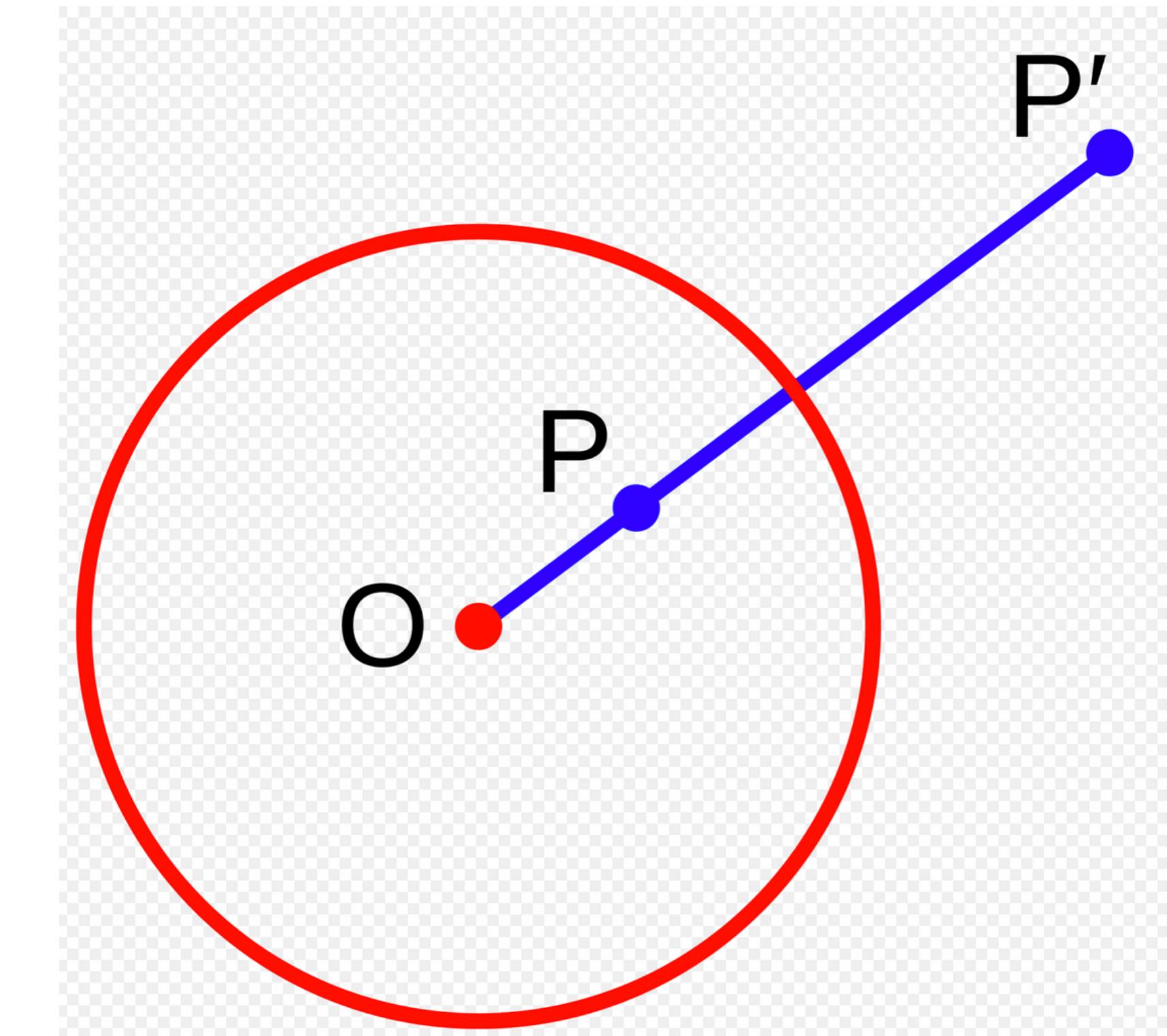


**En violet : courbe directrice**  
**En rouge : courbe génératrice**



# Inversion géométrique

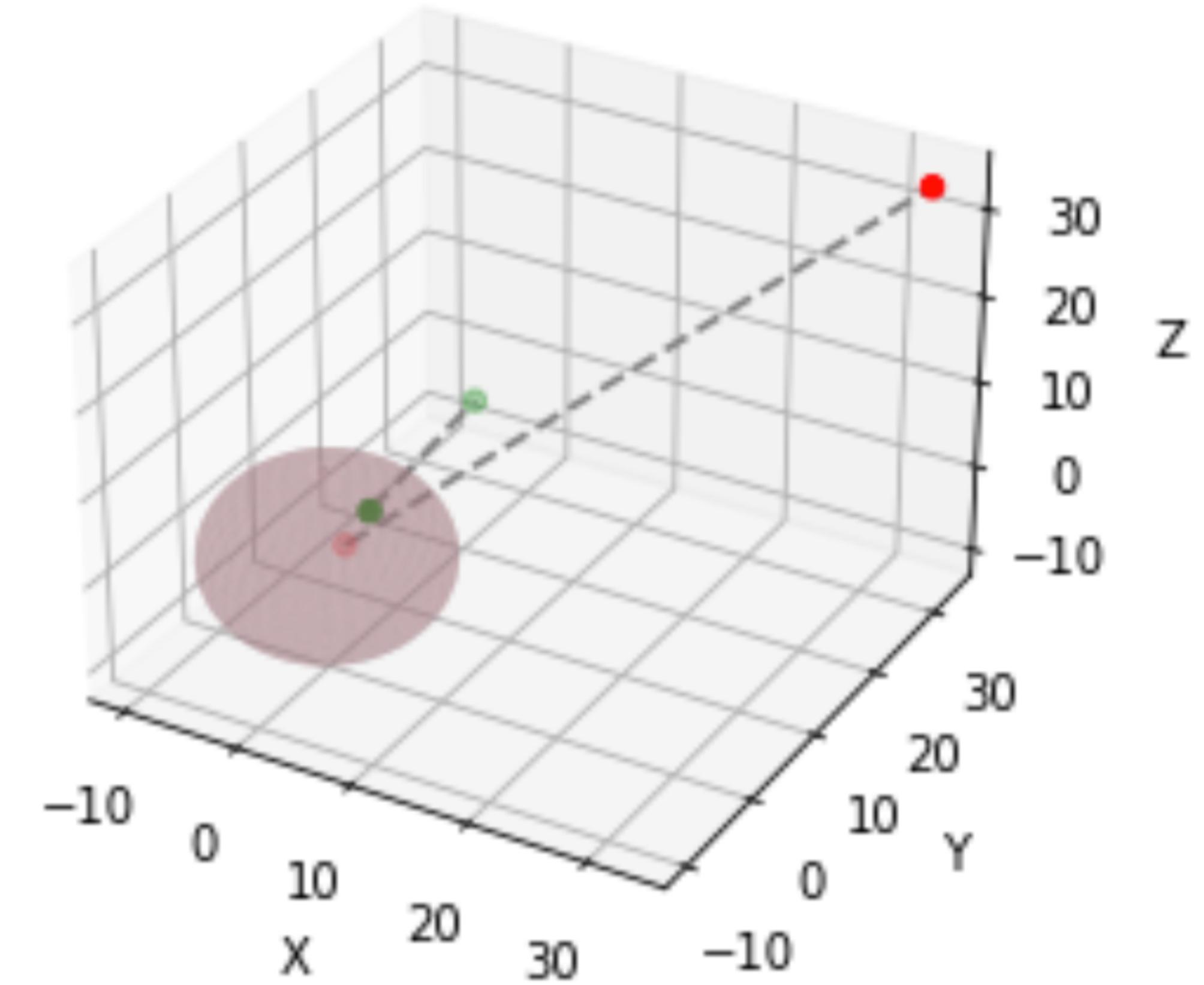
$$OP \cdot OP' = r^2$$



# Inversion géométrique

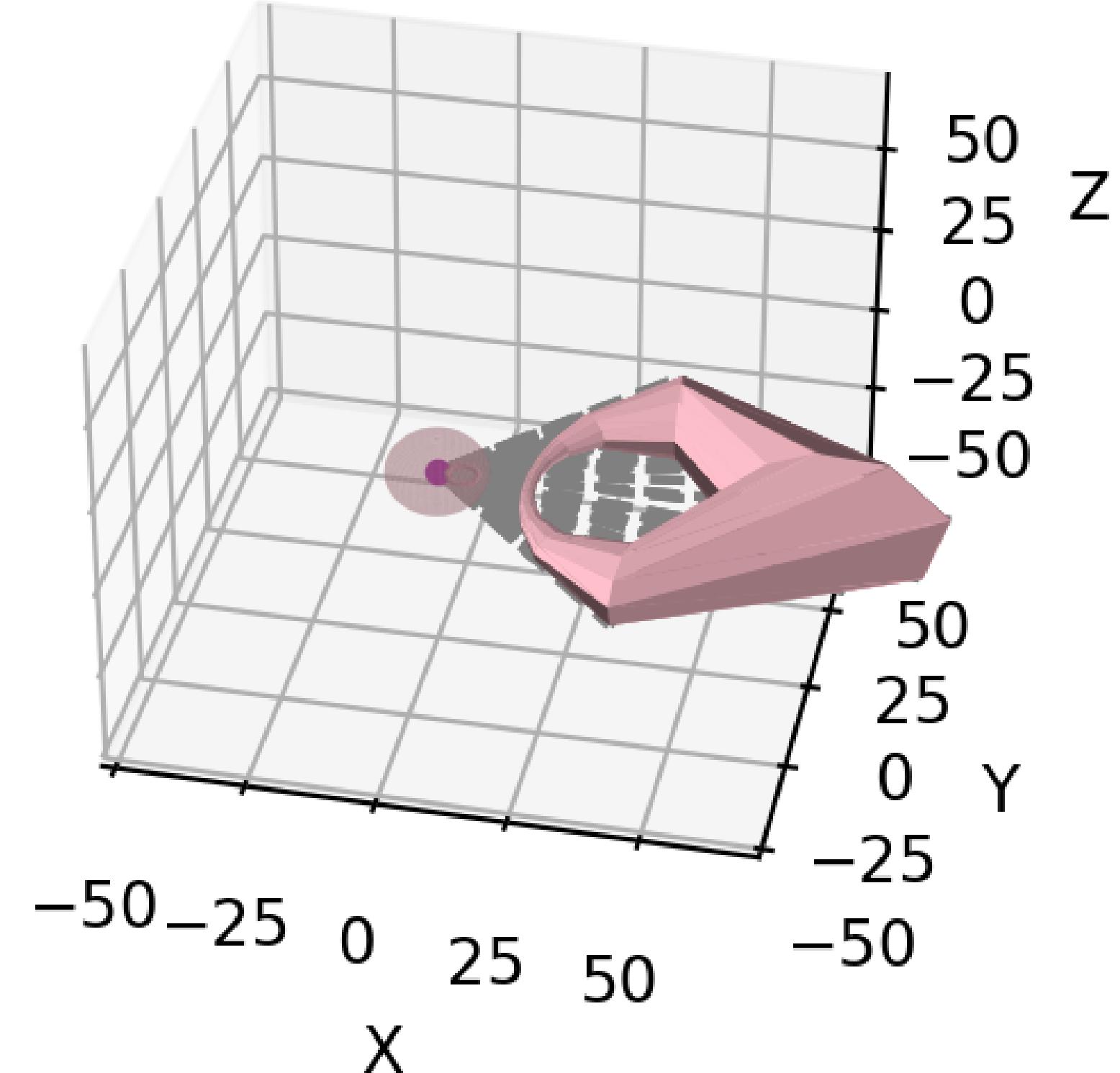
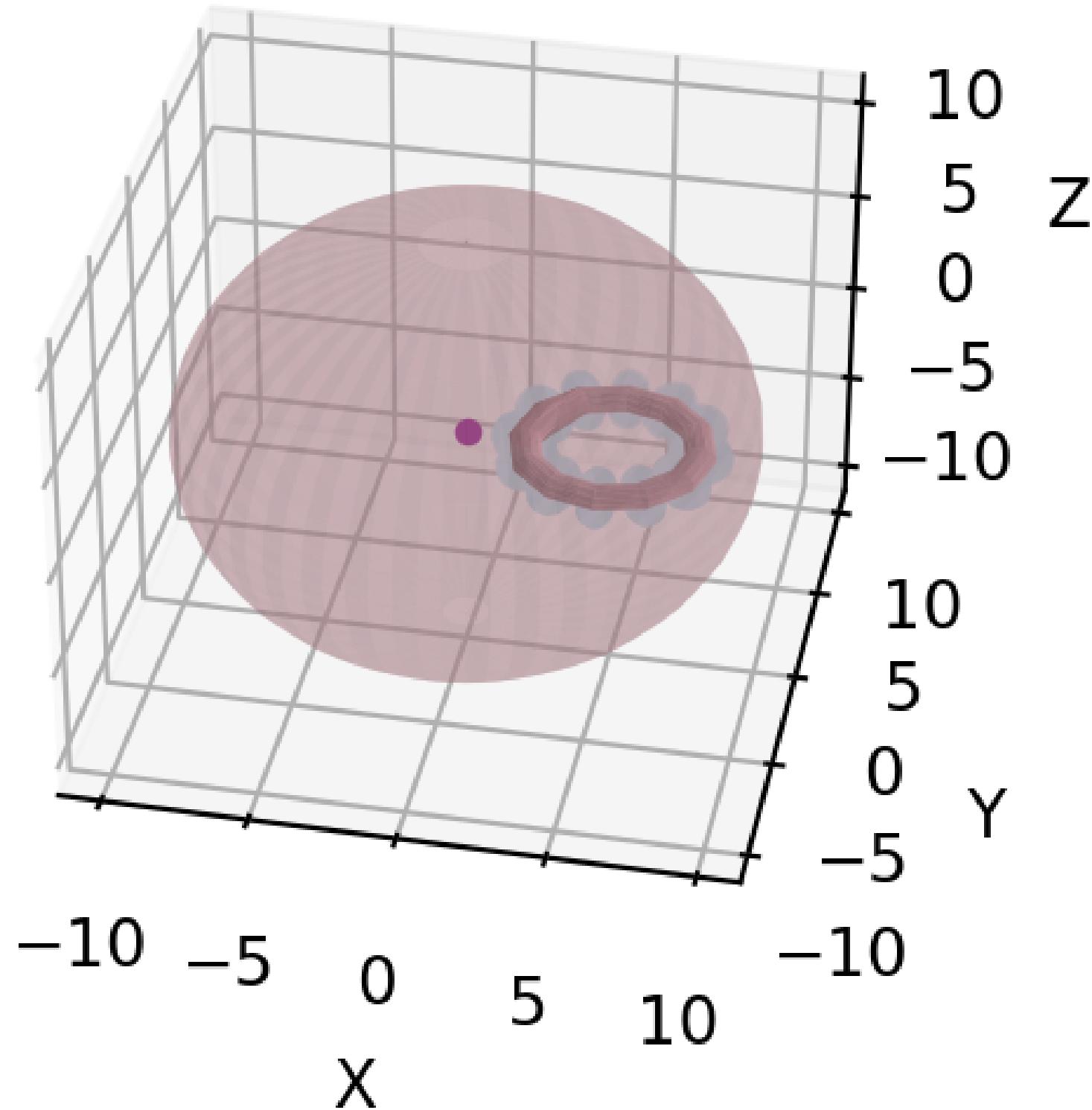
**Inversion de 2 points sur  
Jupyter Notebook:**

- (1,1,1)
- (2,3,4)



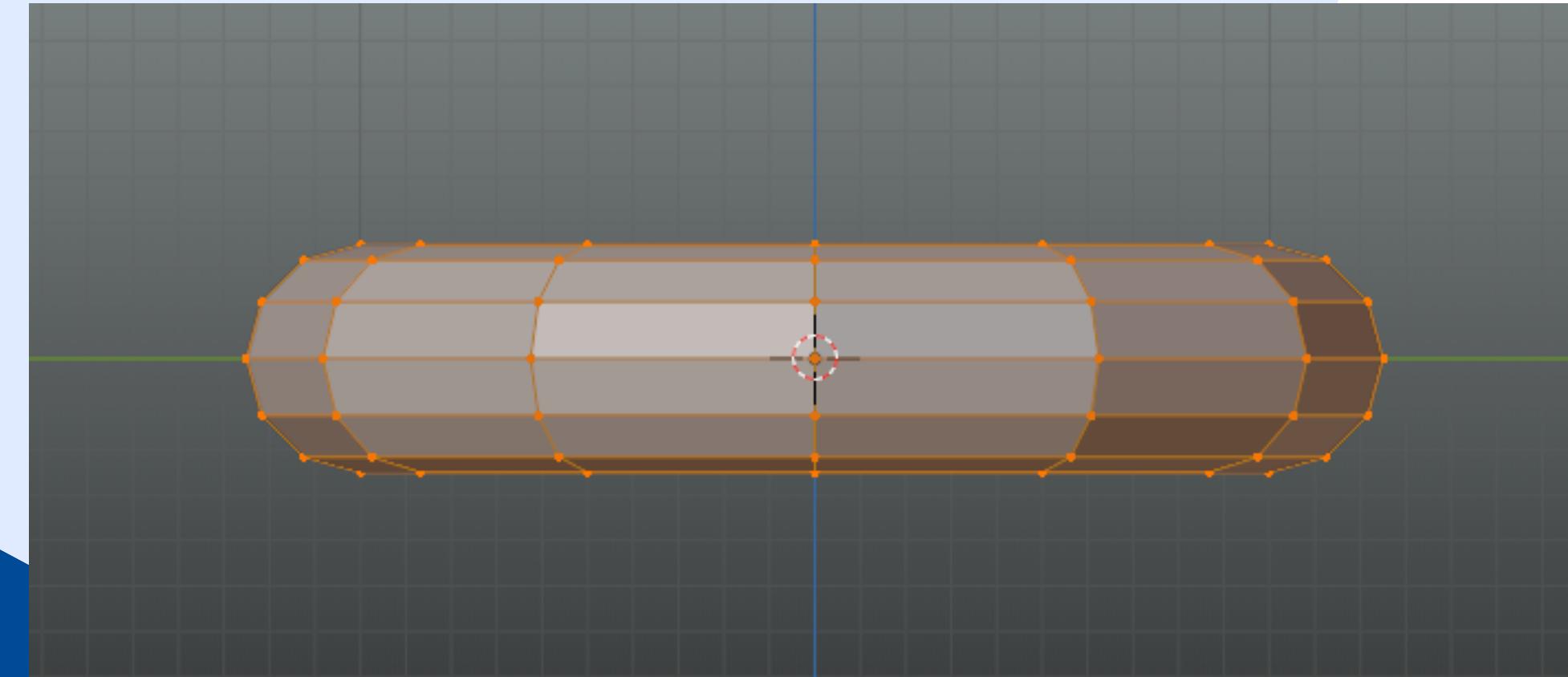
# Inversion géométrique

**Inversion d'un tore avec 15 cercles générateurs sur Jupyter Notebook :**

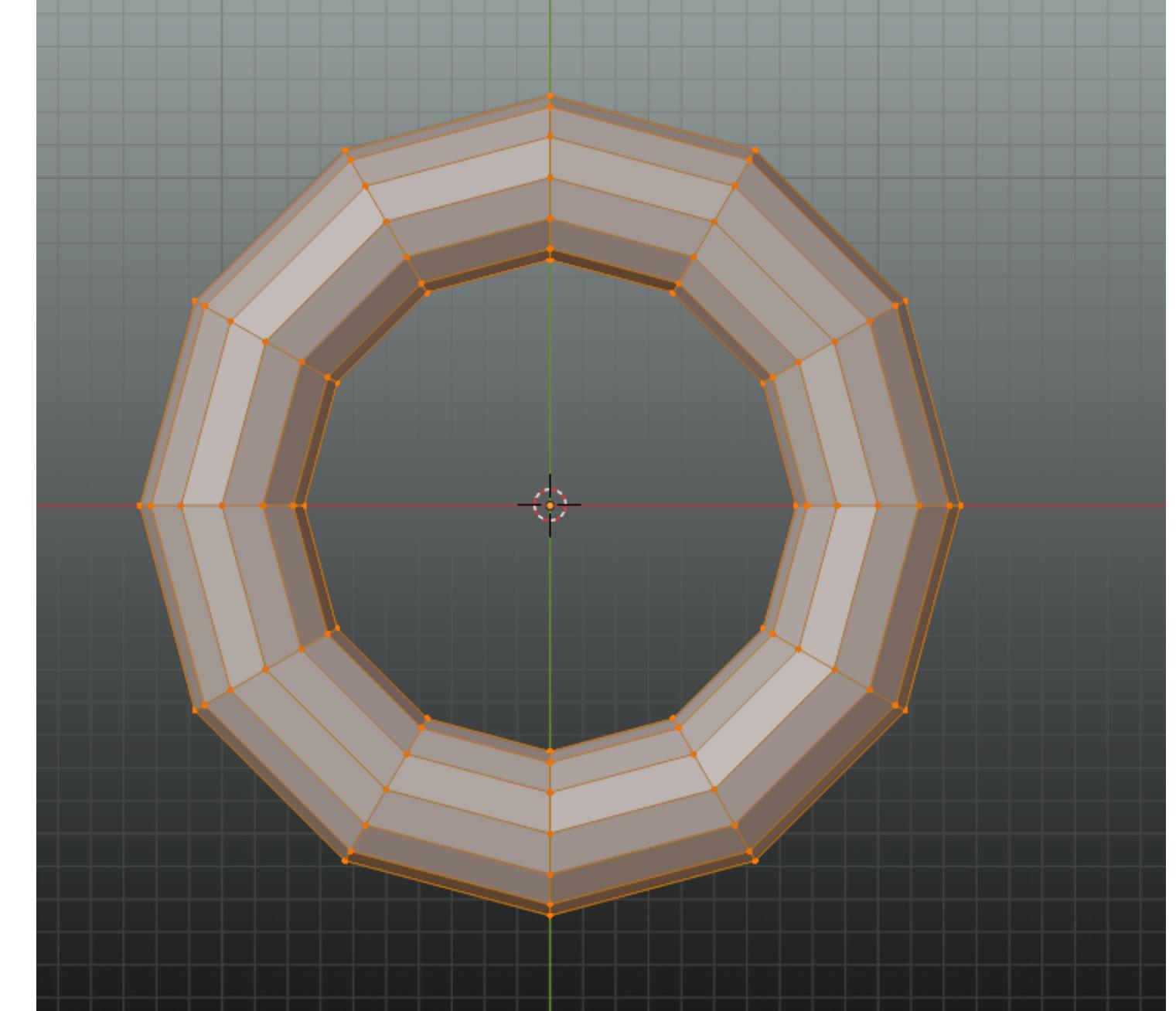


# Tore sur Blender

**Vue latérale**



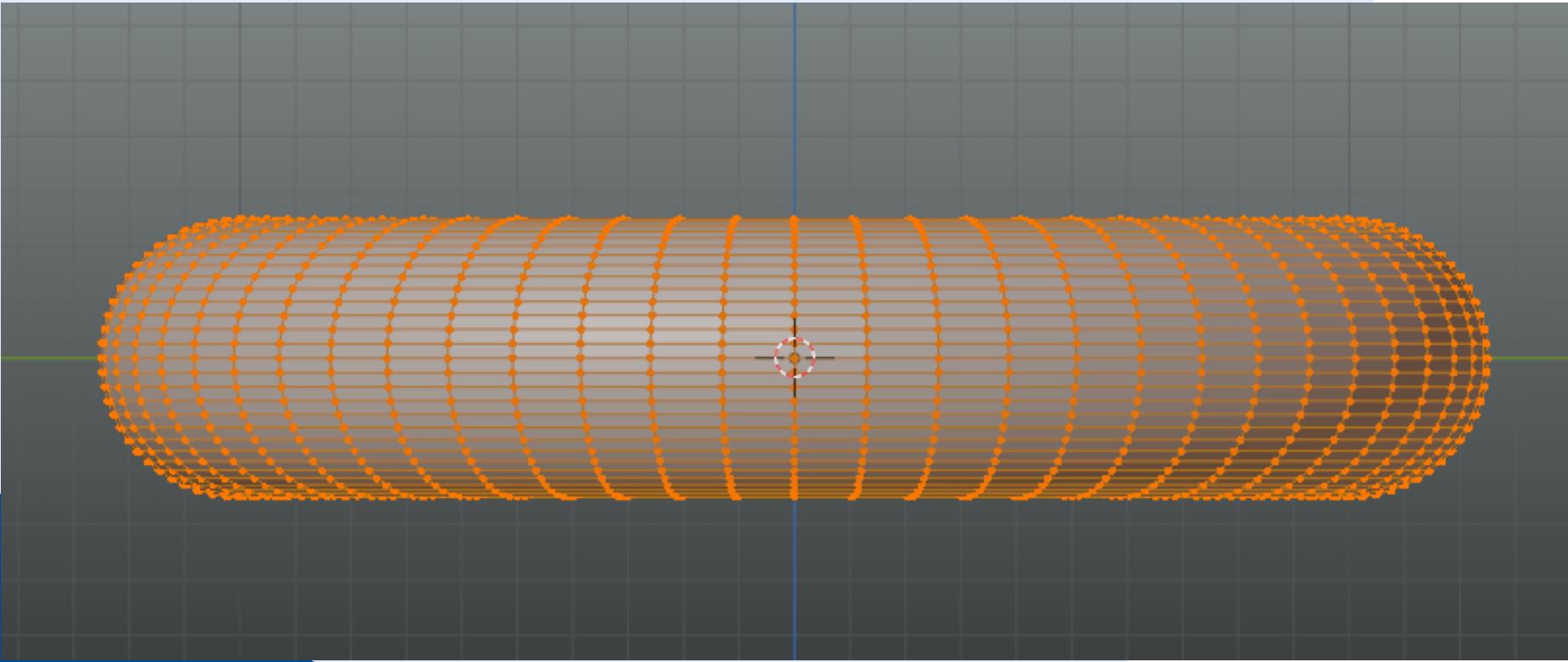
**Vue de dessus**



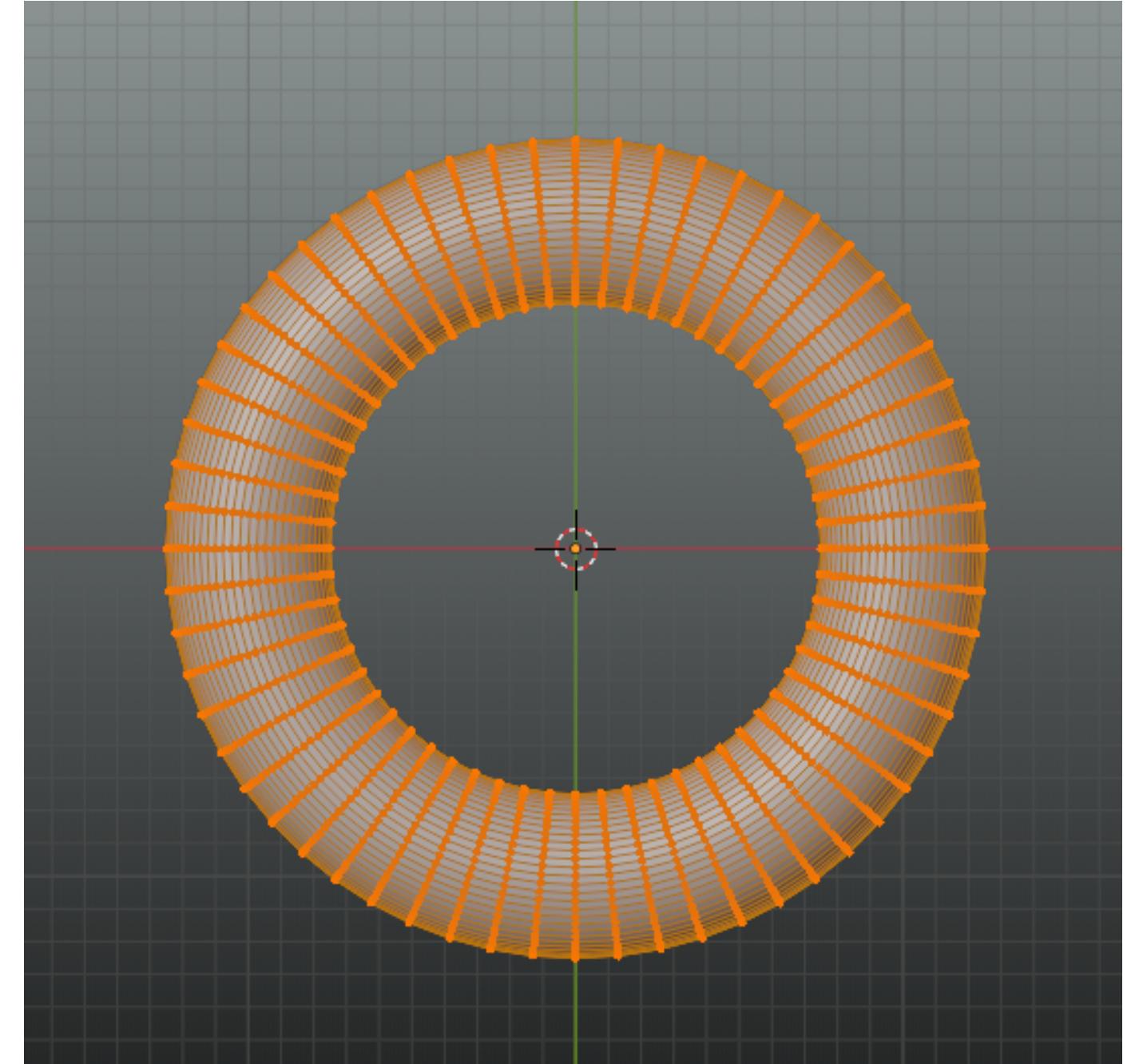
**taille : 12x12**

# Tore sur Blender

**Vue latérale**

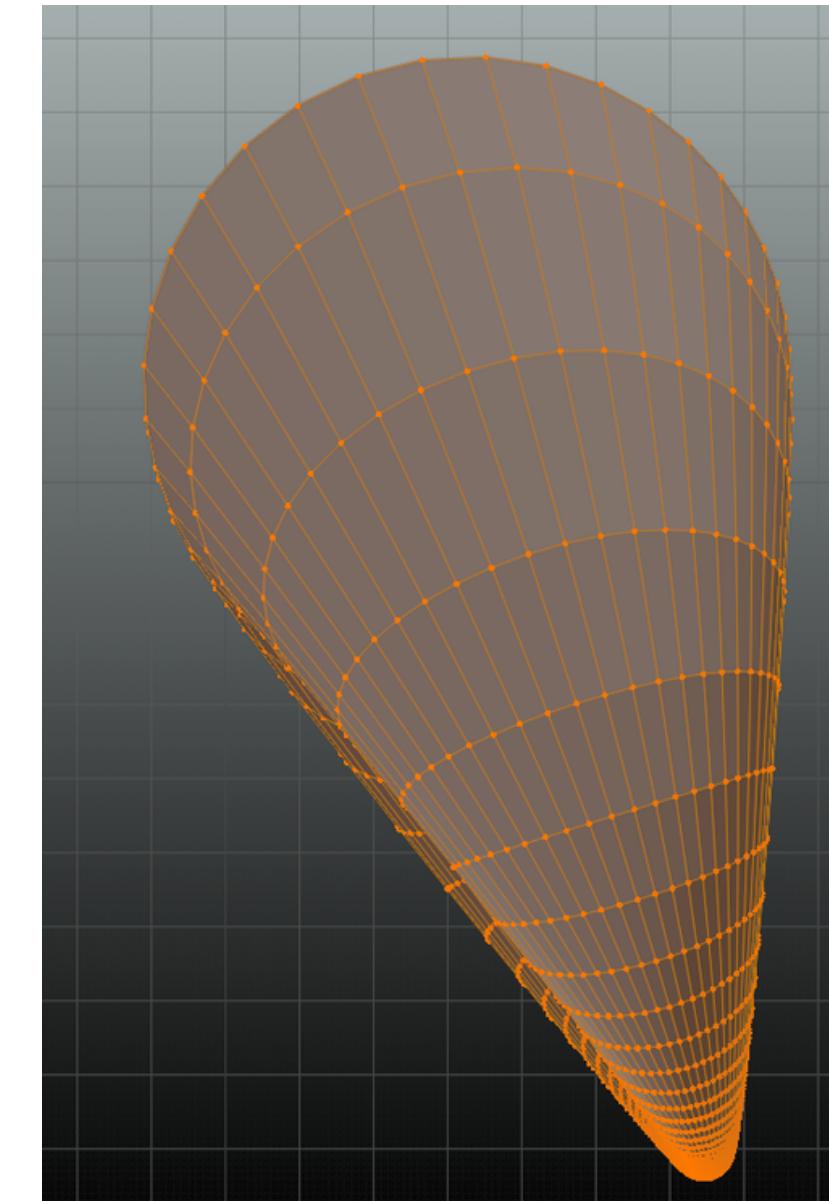
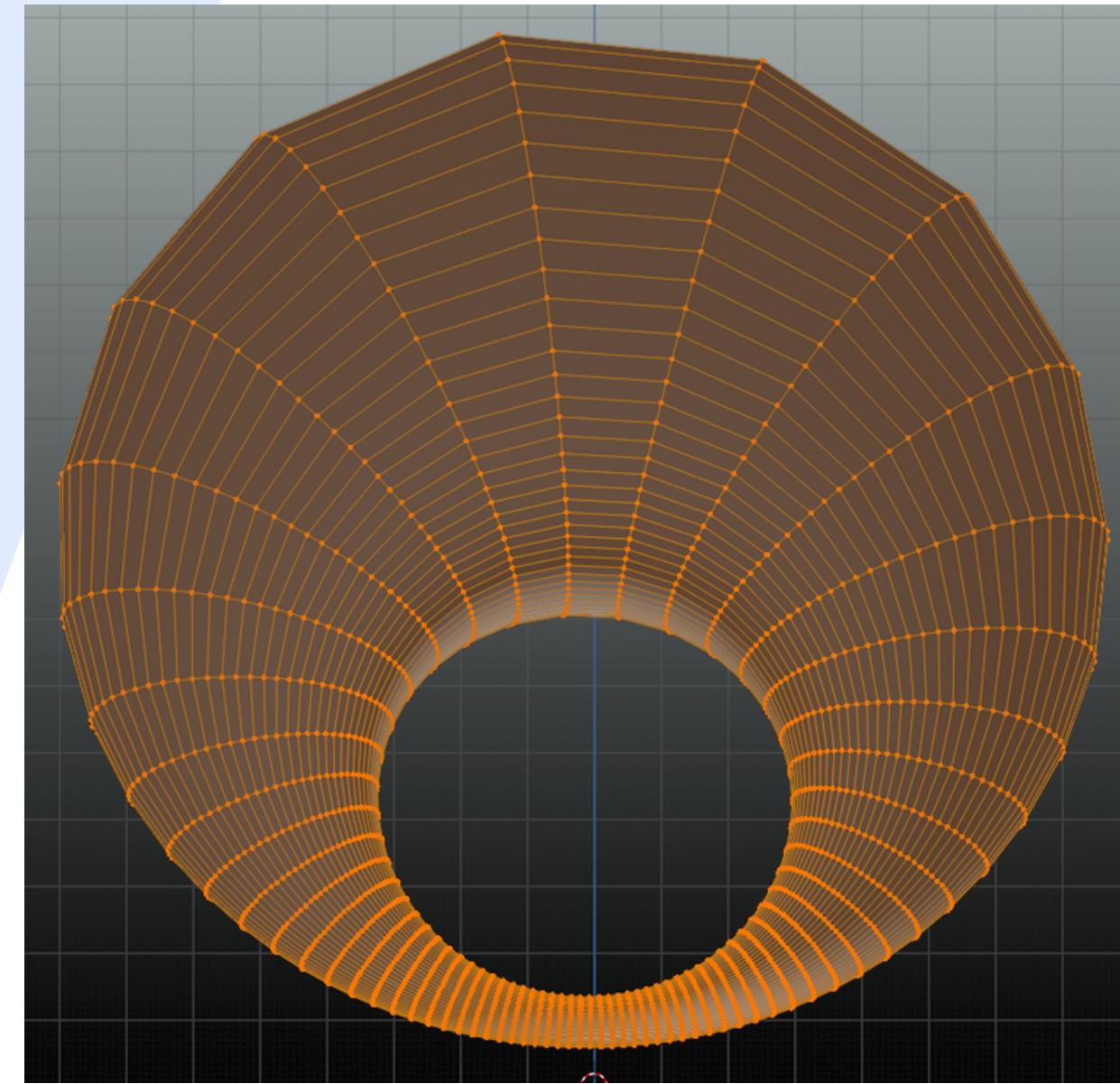
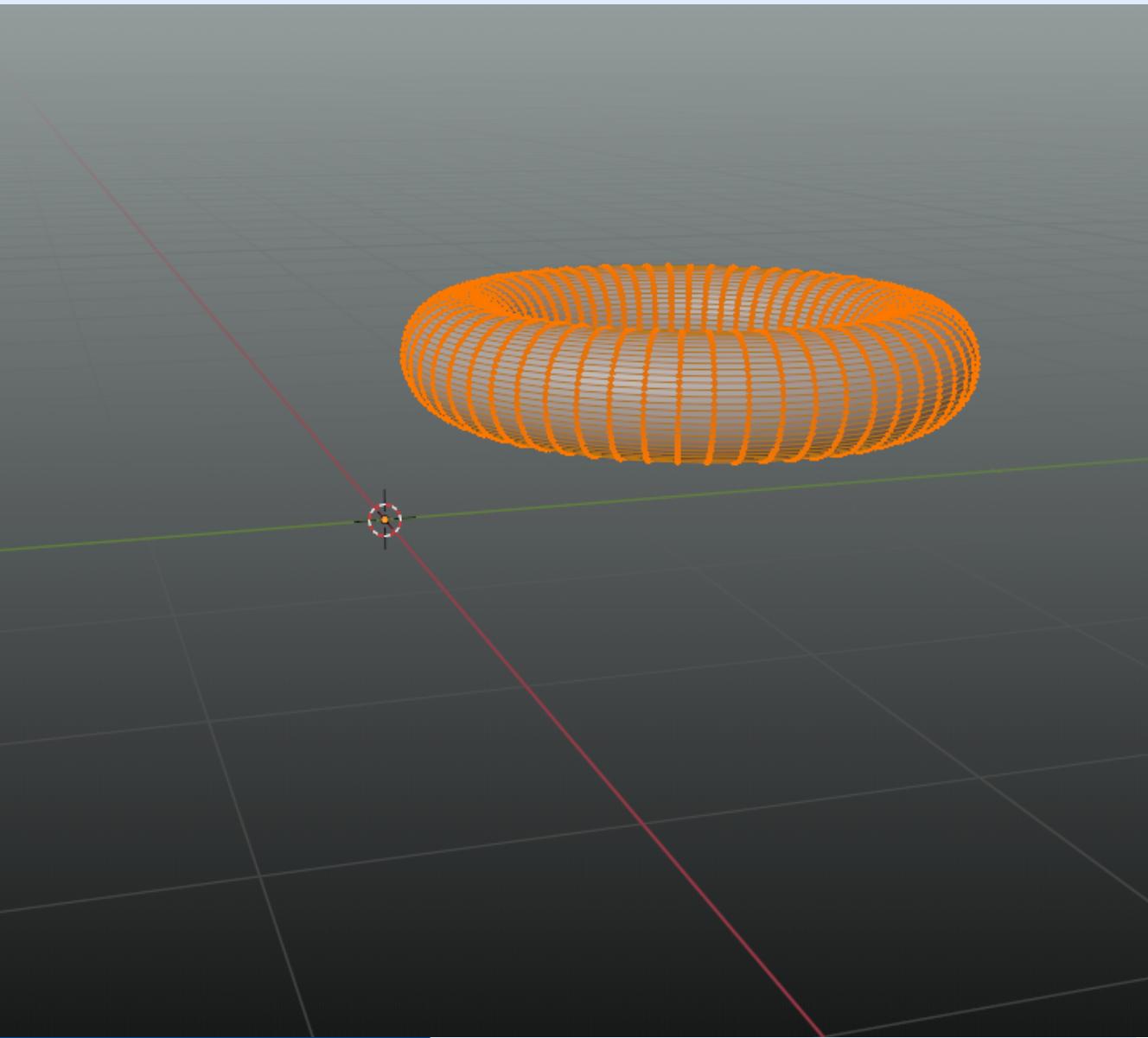


**Vue de dessus**



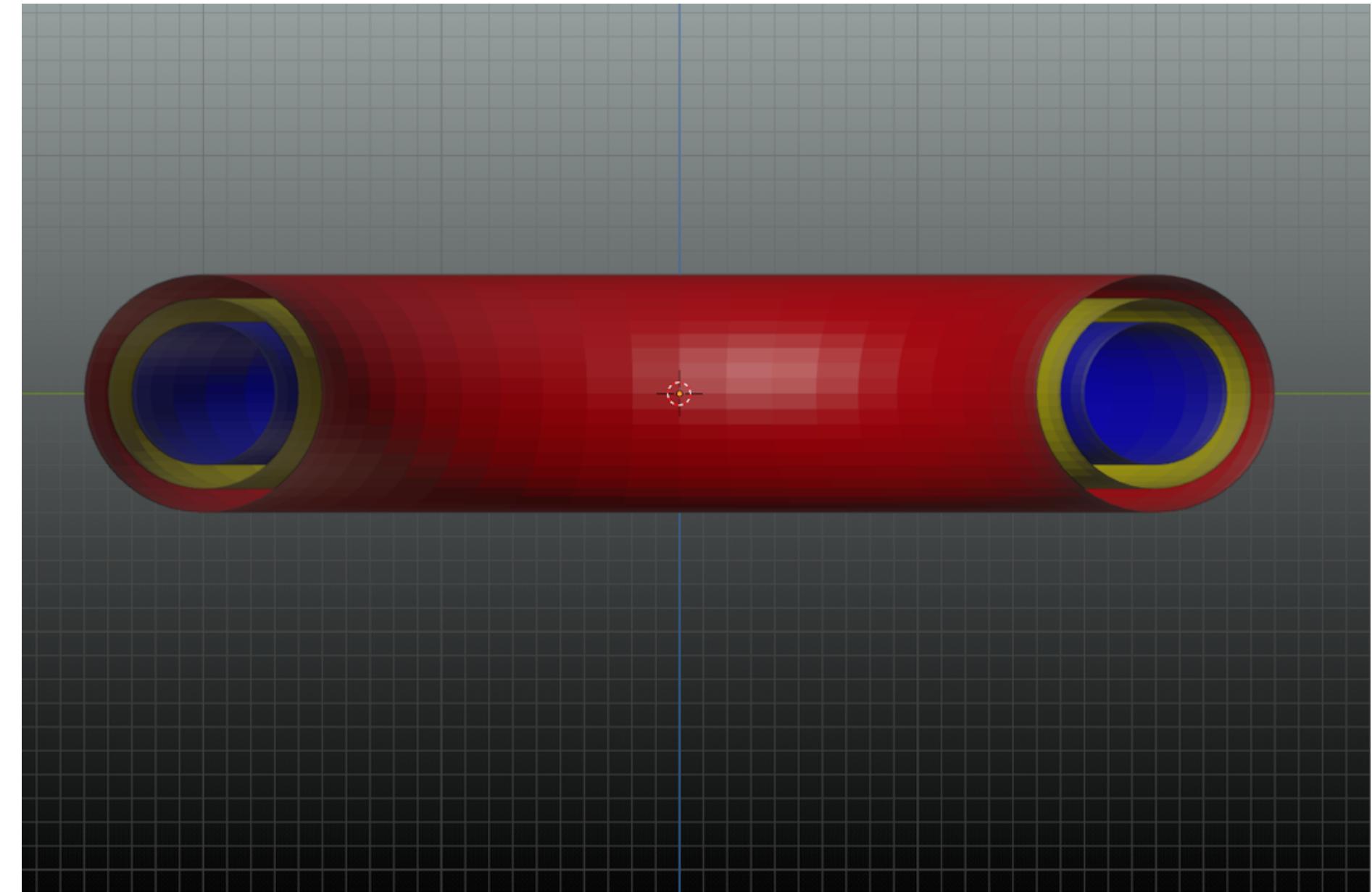
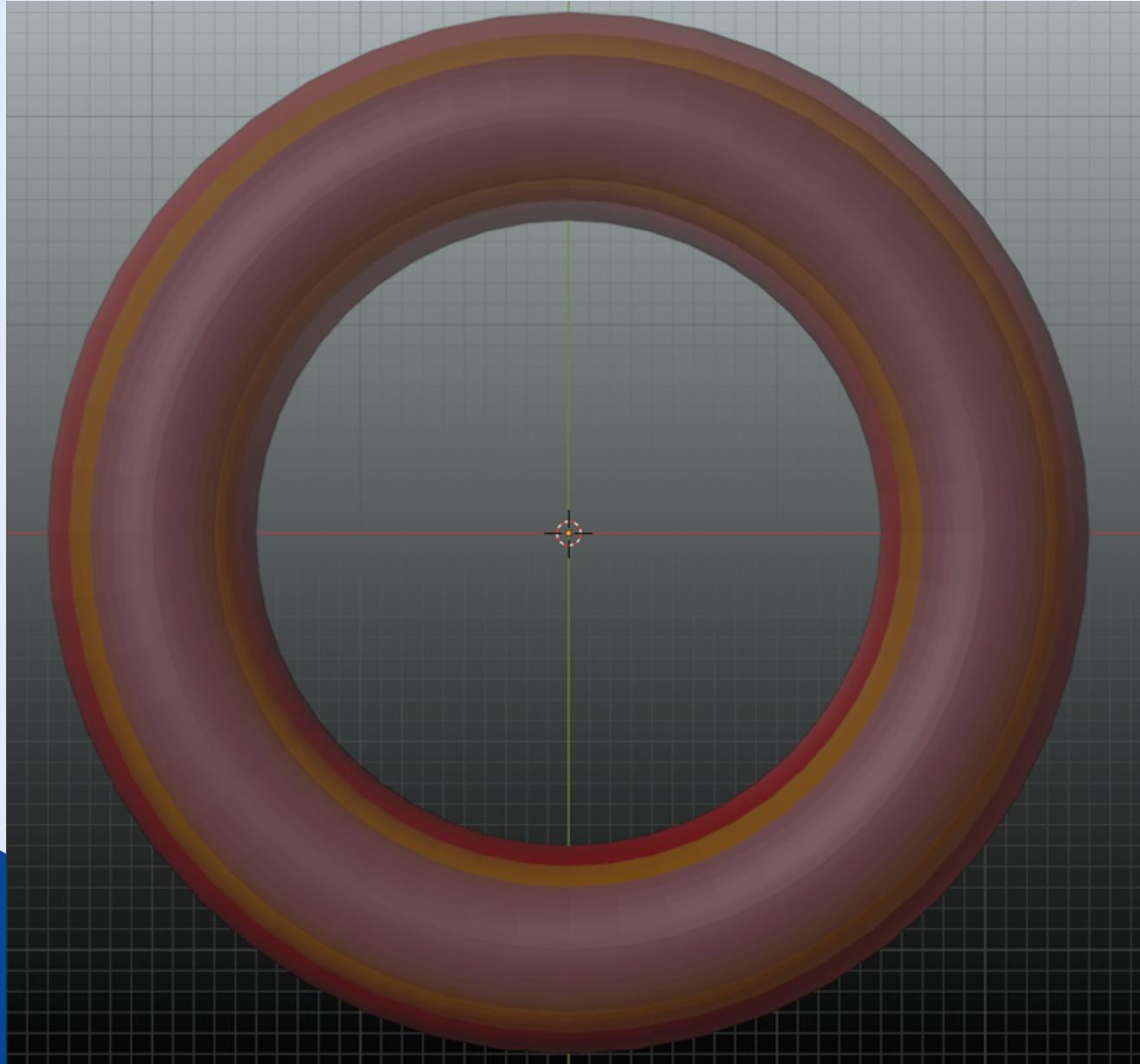
**taille : 60x60**

# Inversion du tore



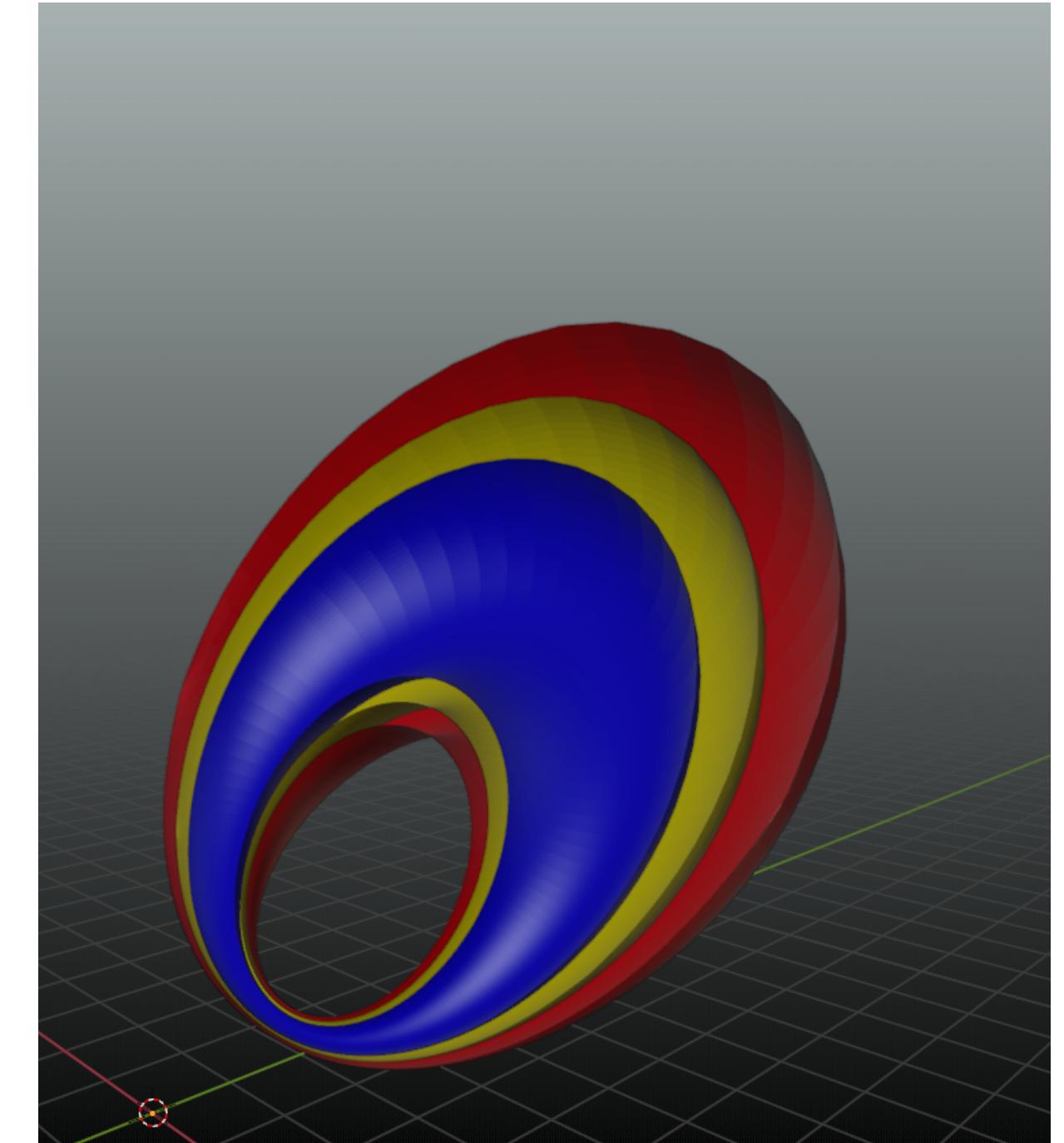
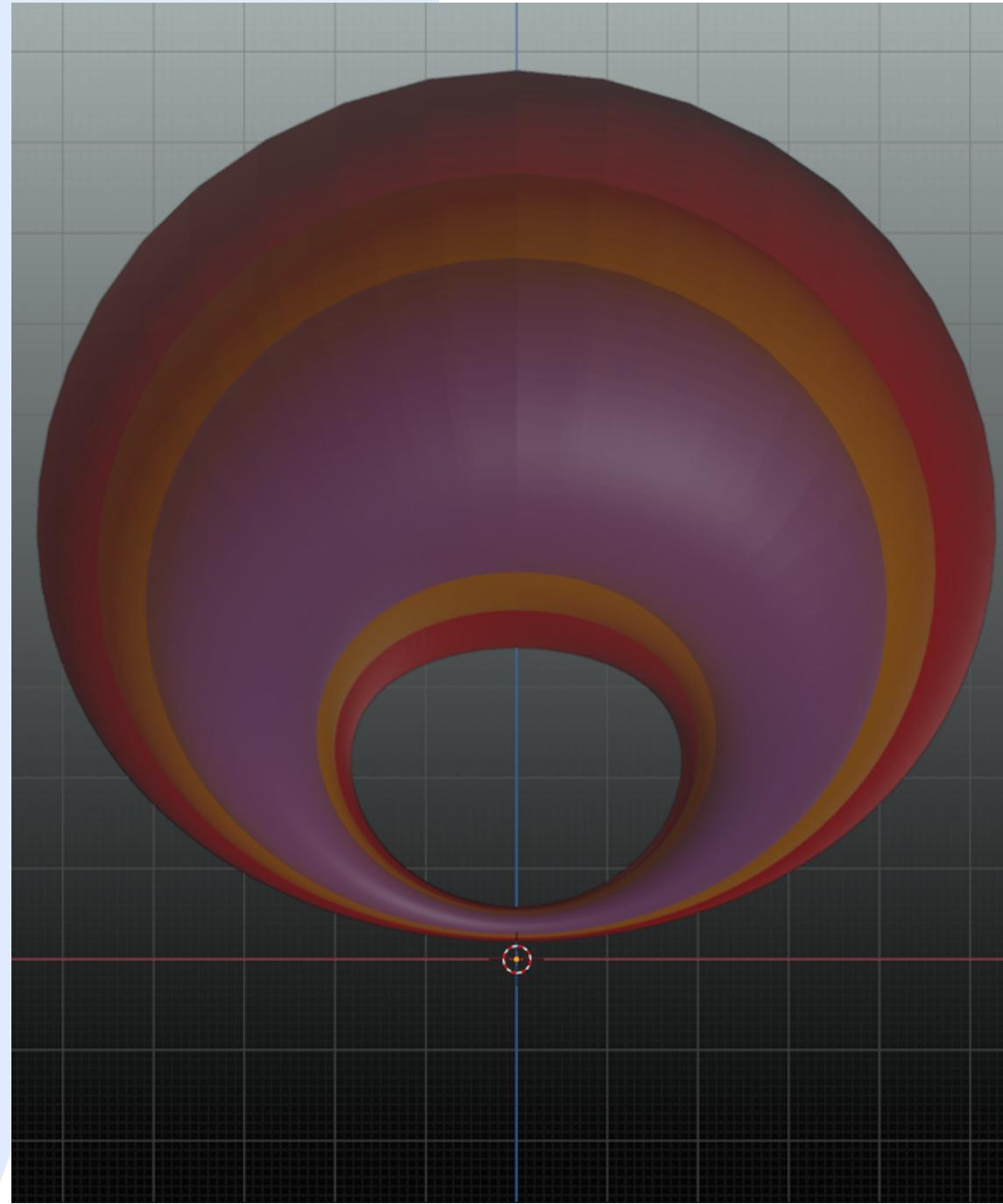
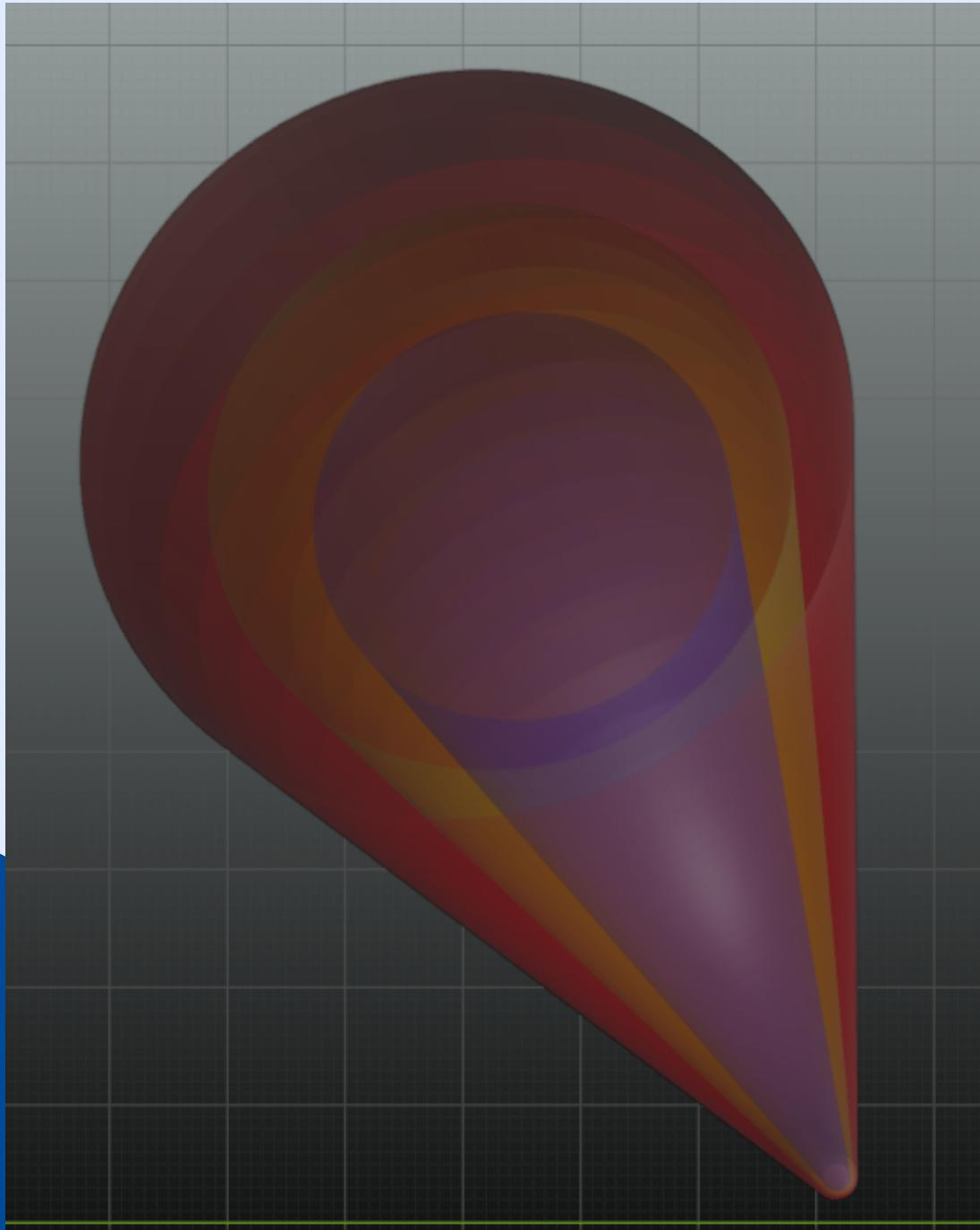
**taille : 60x60**

# Imbrication des tores



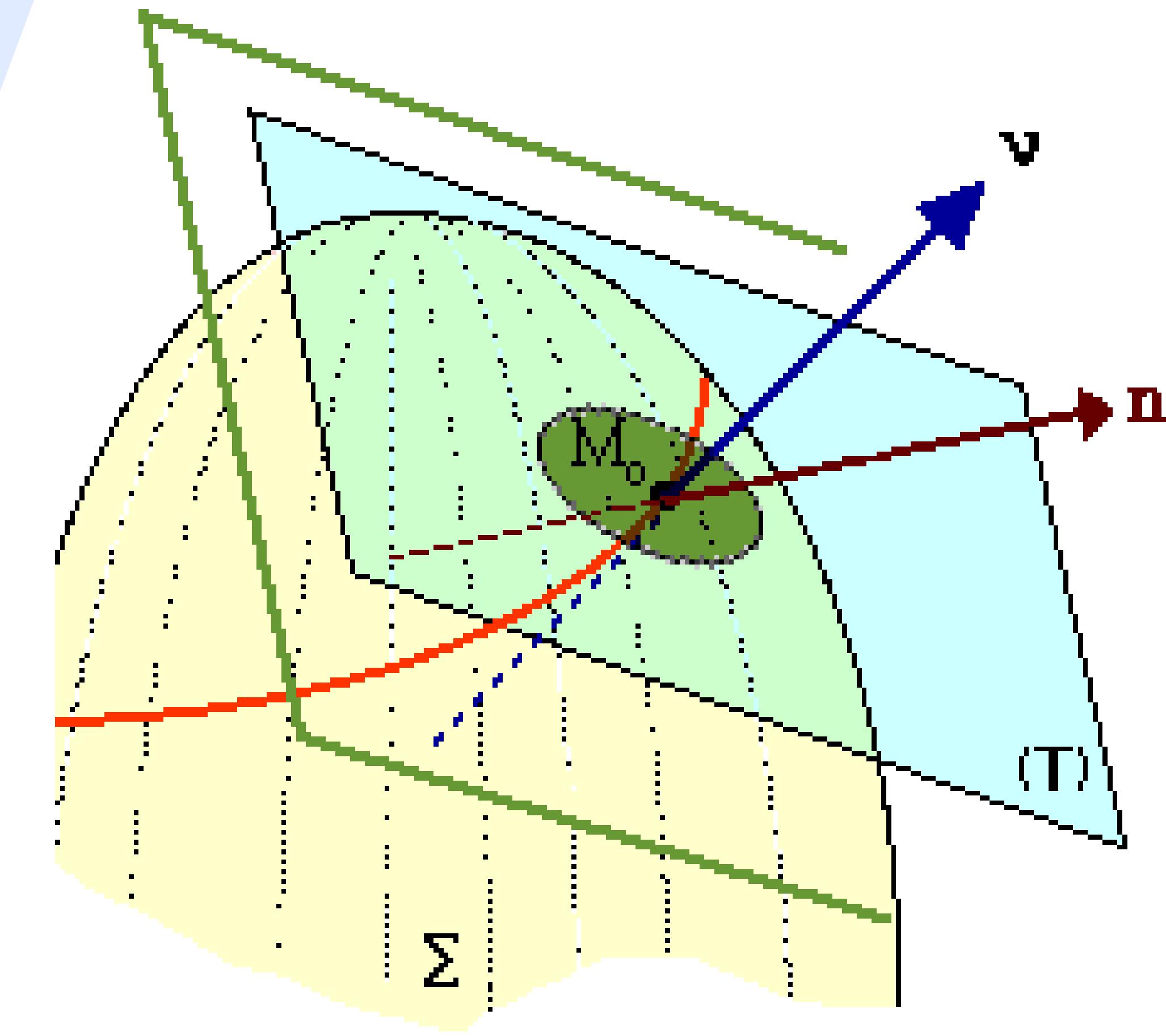
taille : 60x60

# Imbrication des cyclides

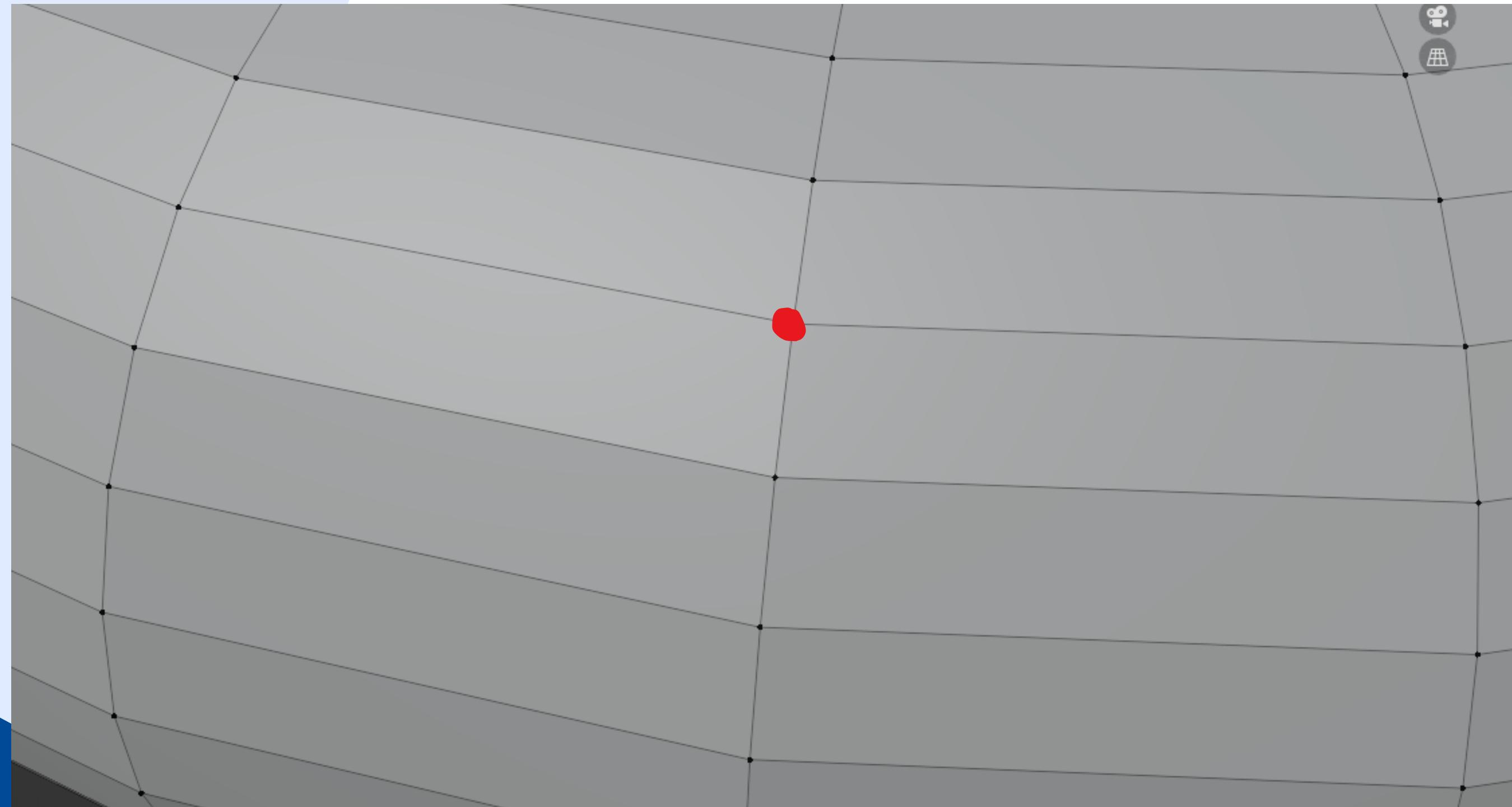


taille : 60x60

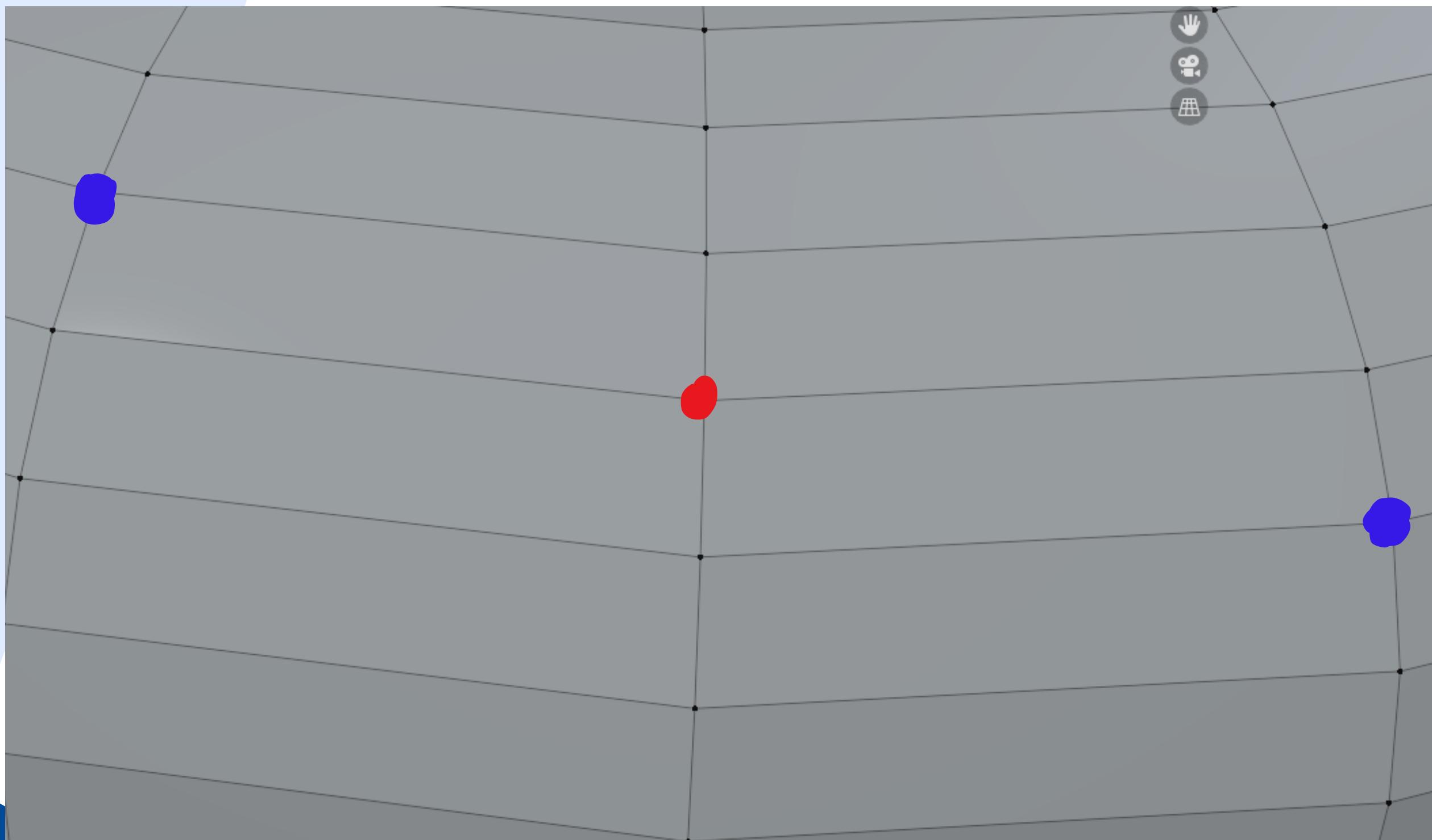
# Géodésiques



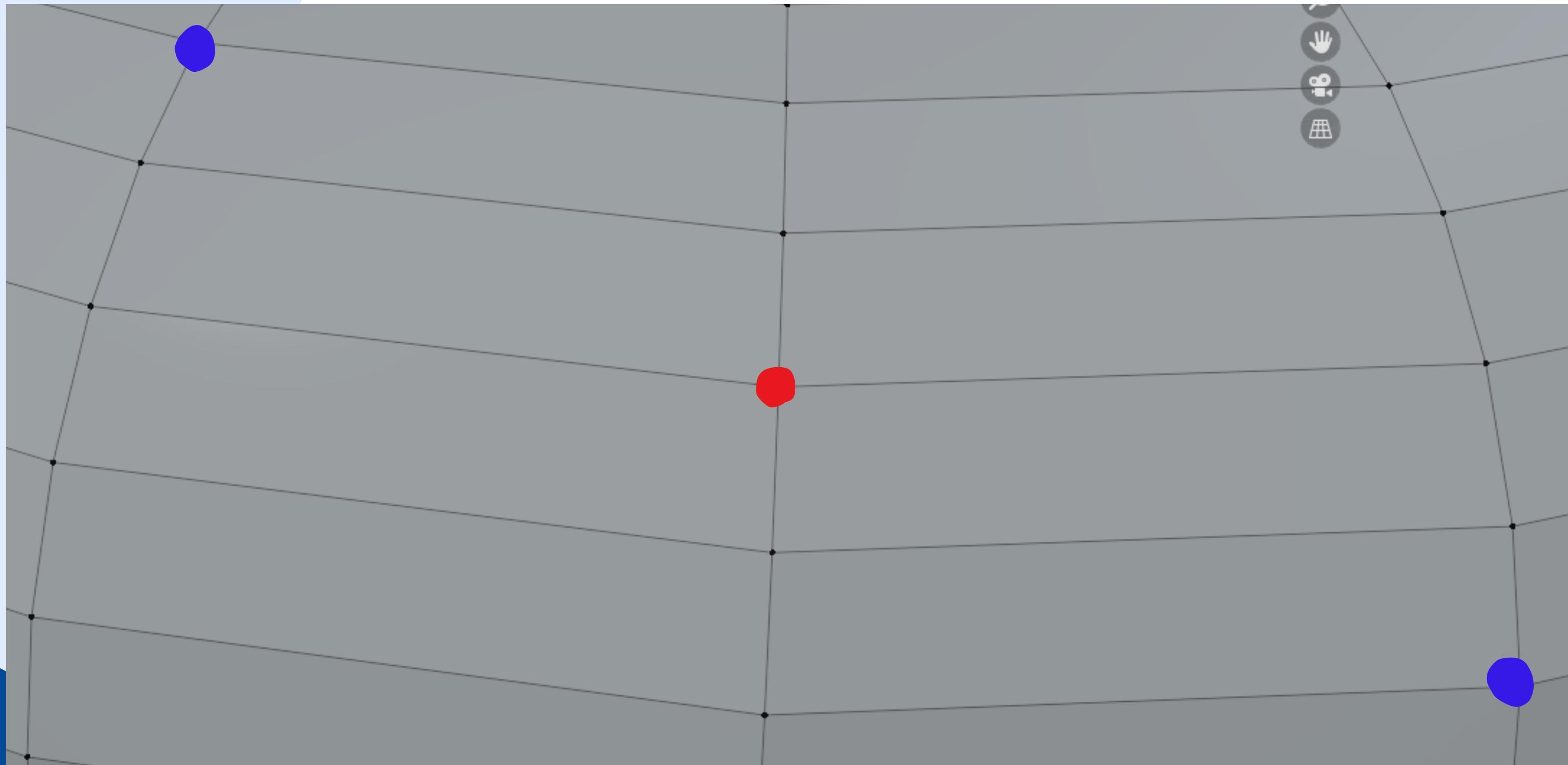
# Géodésiques



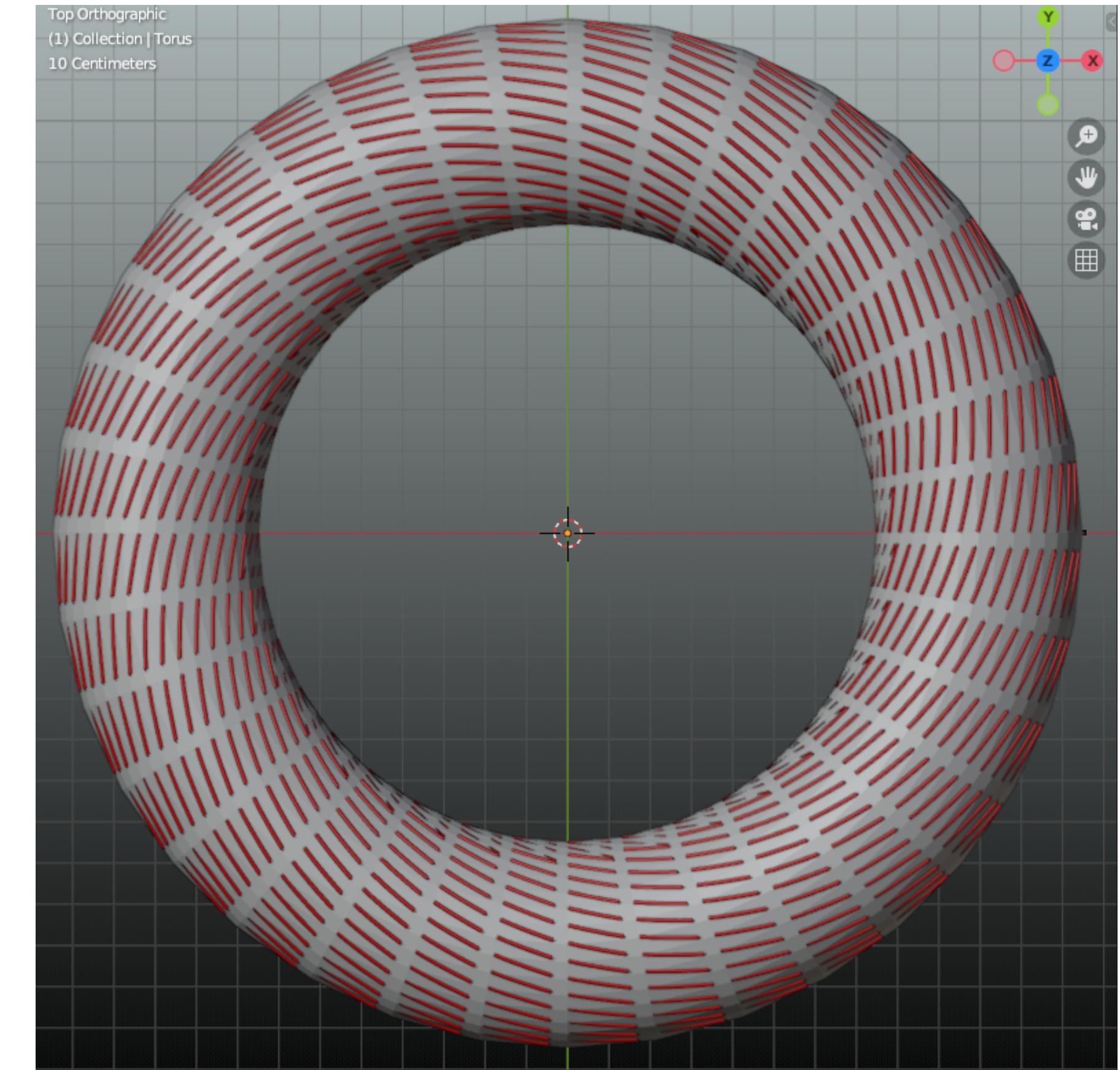
# Géodésiques



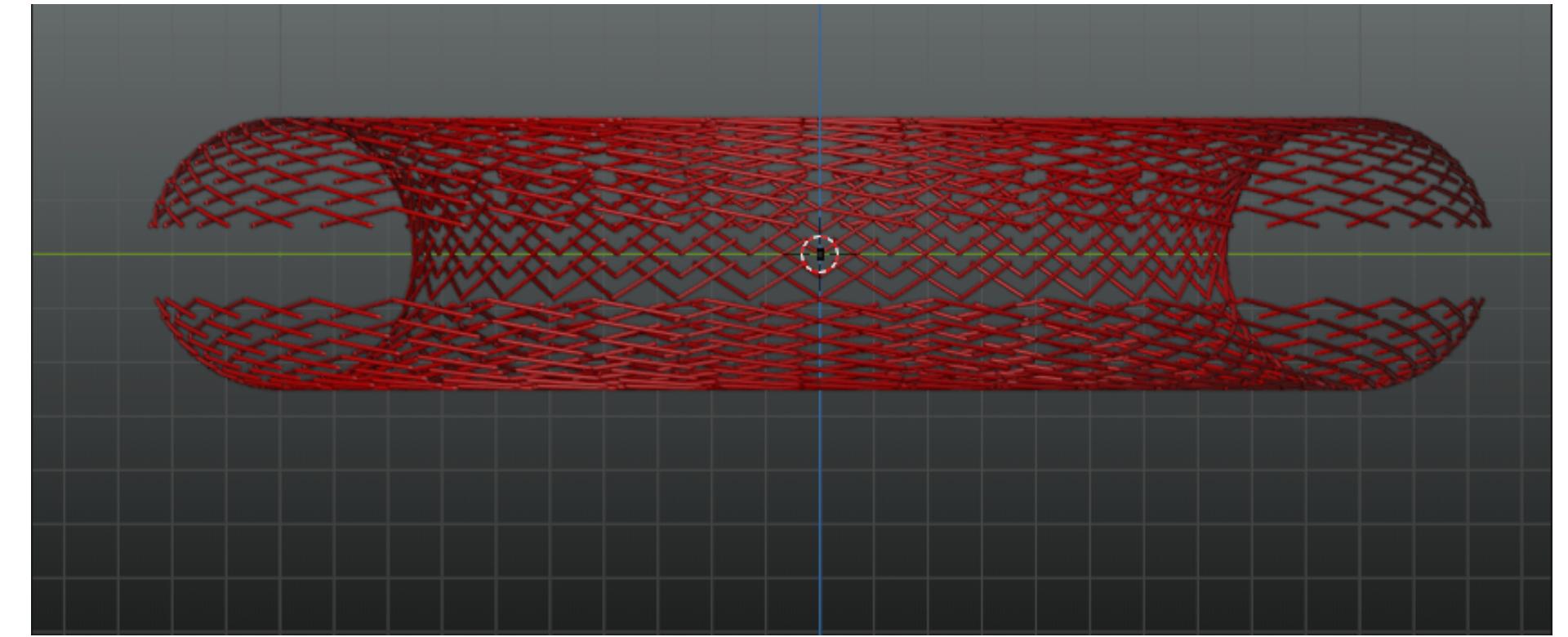
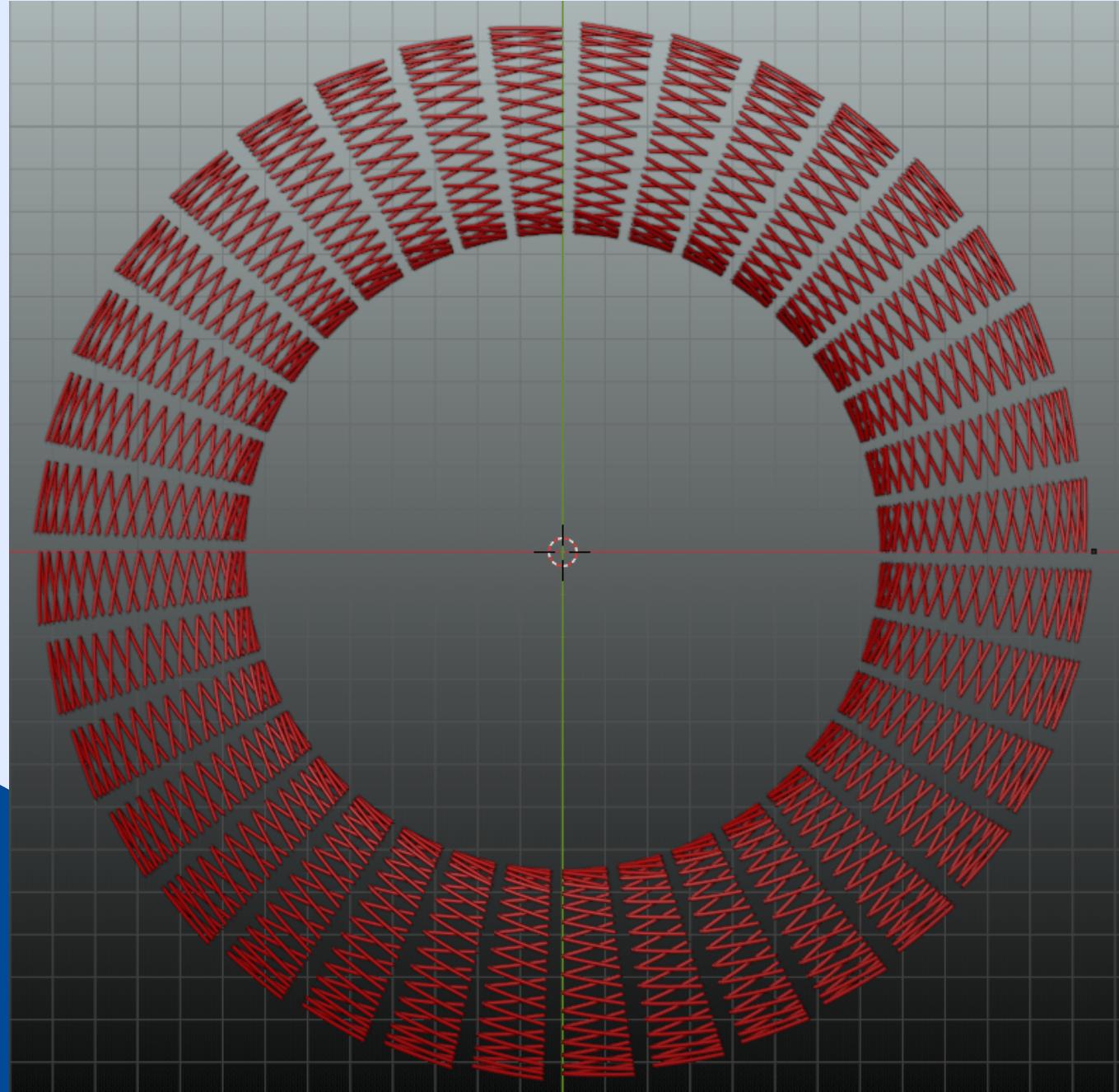
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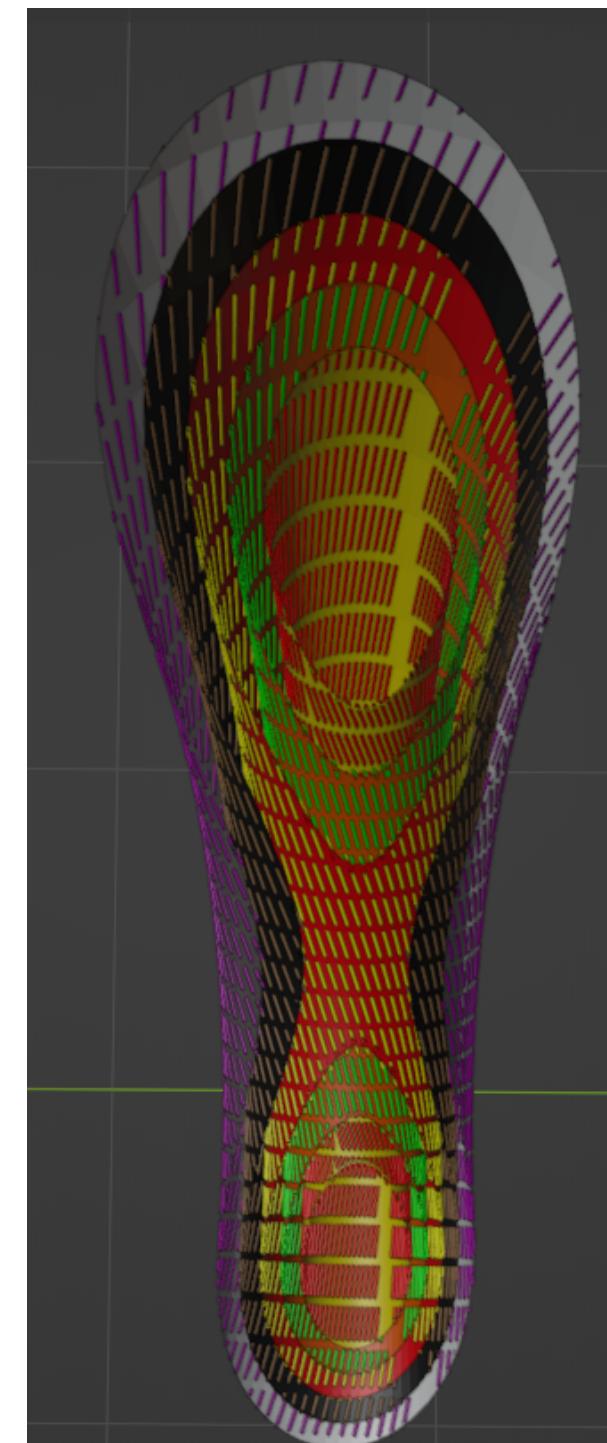
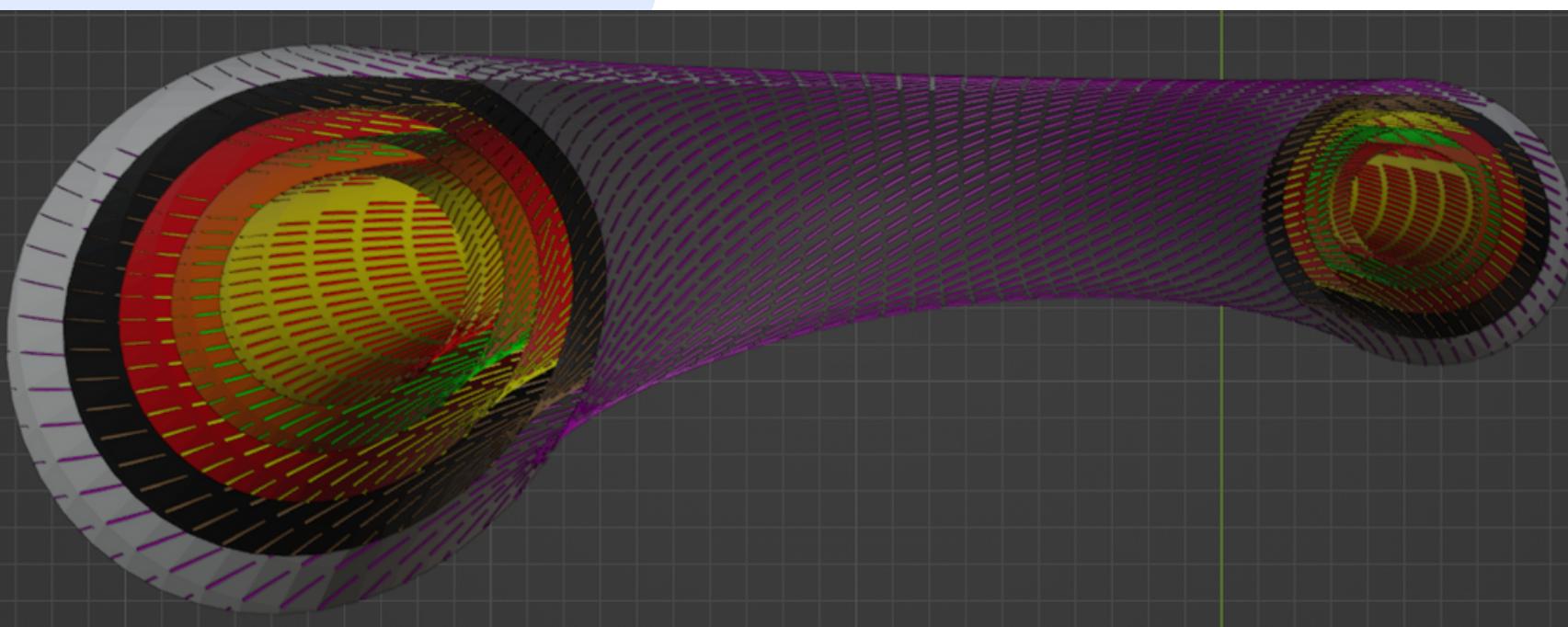
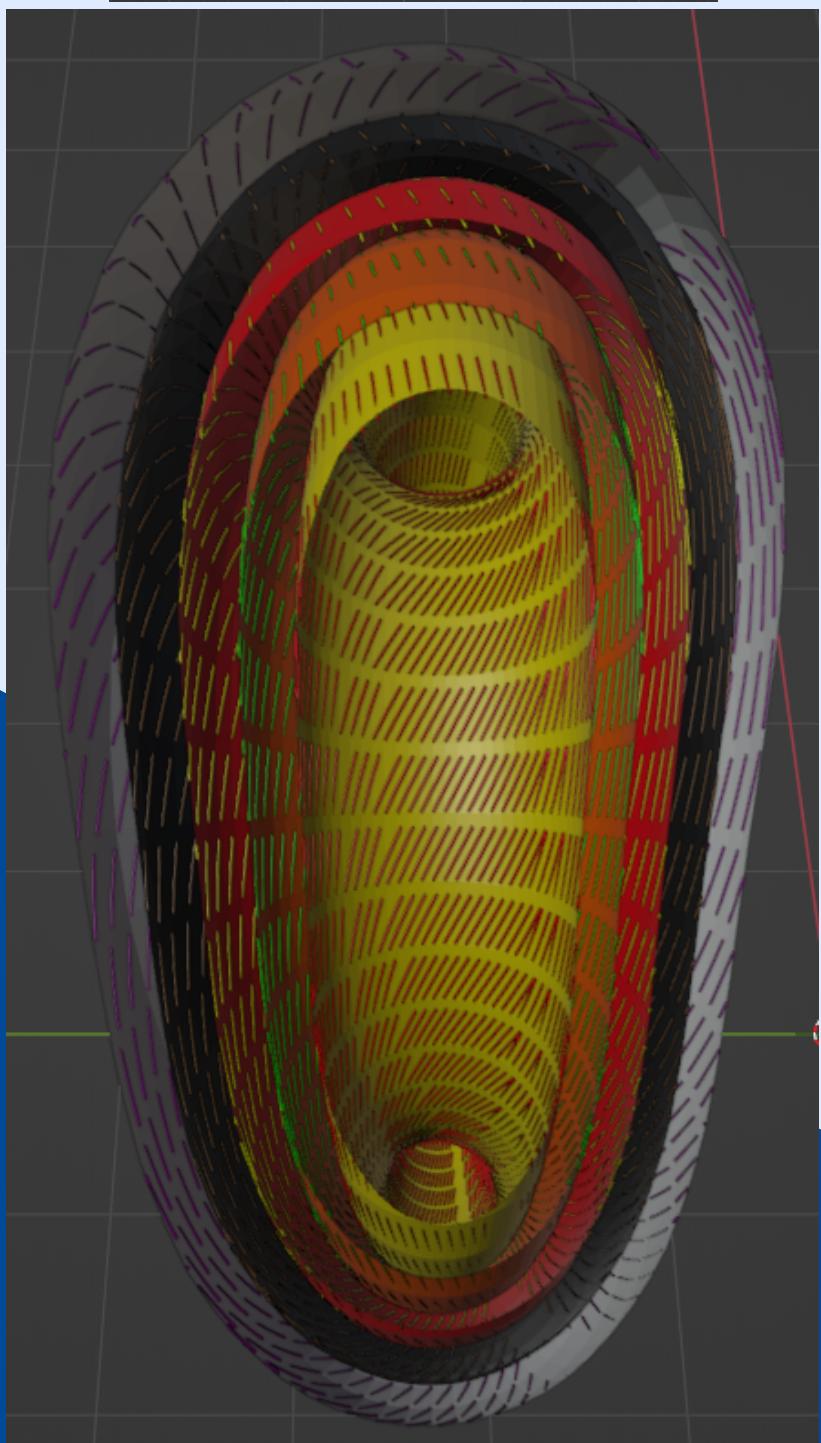
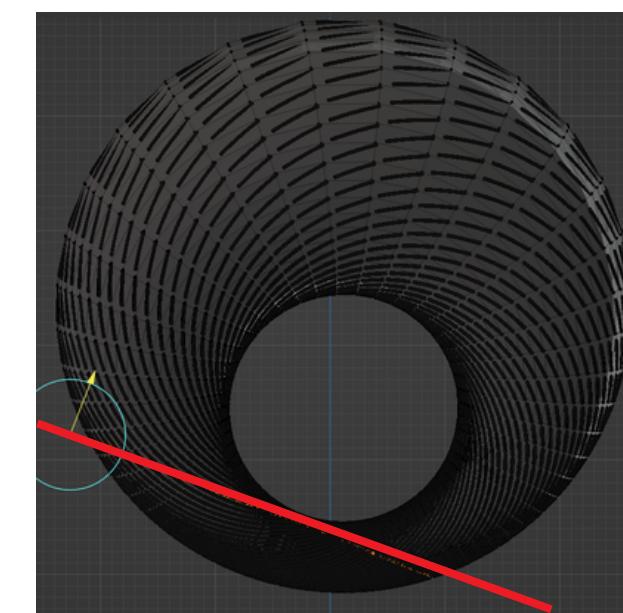
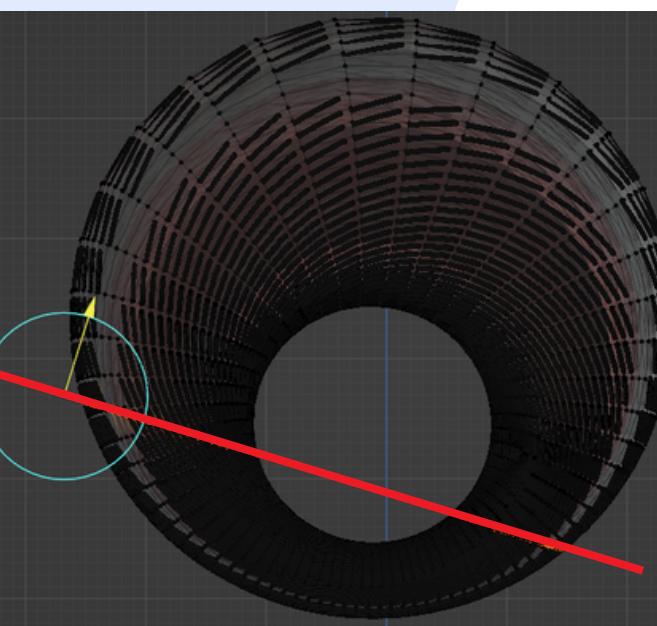
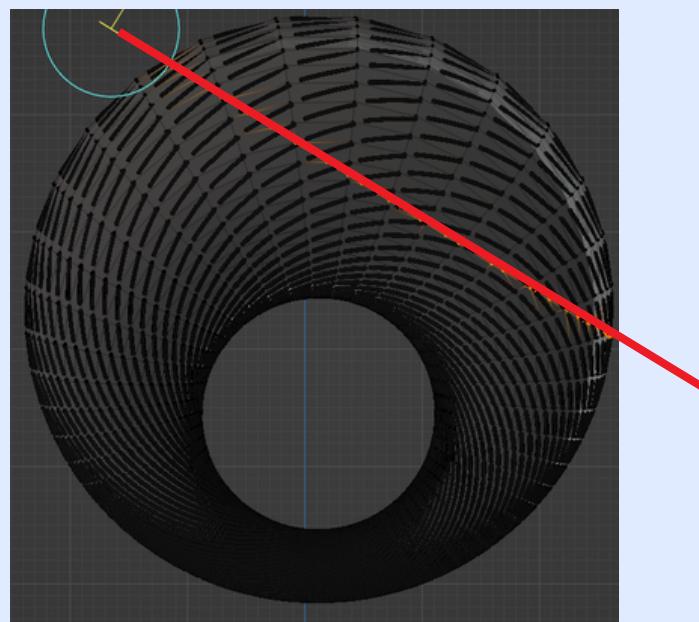


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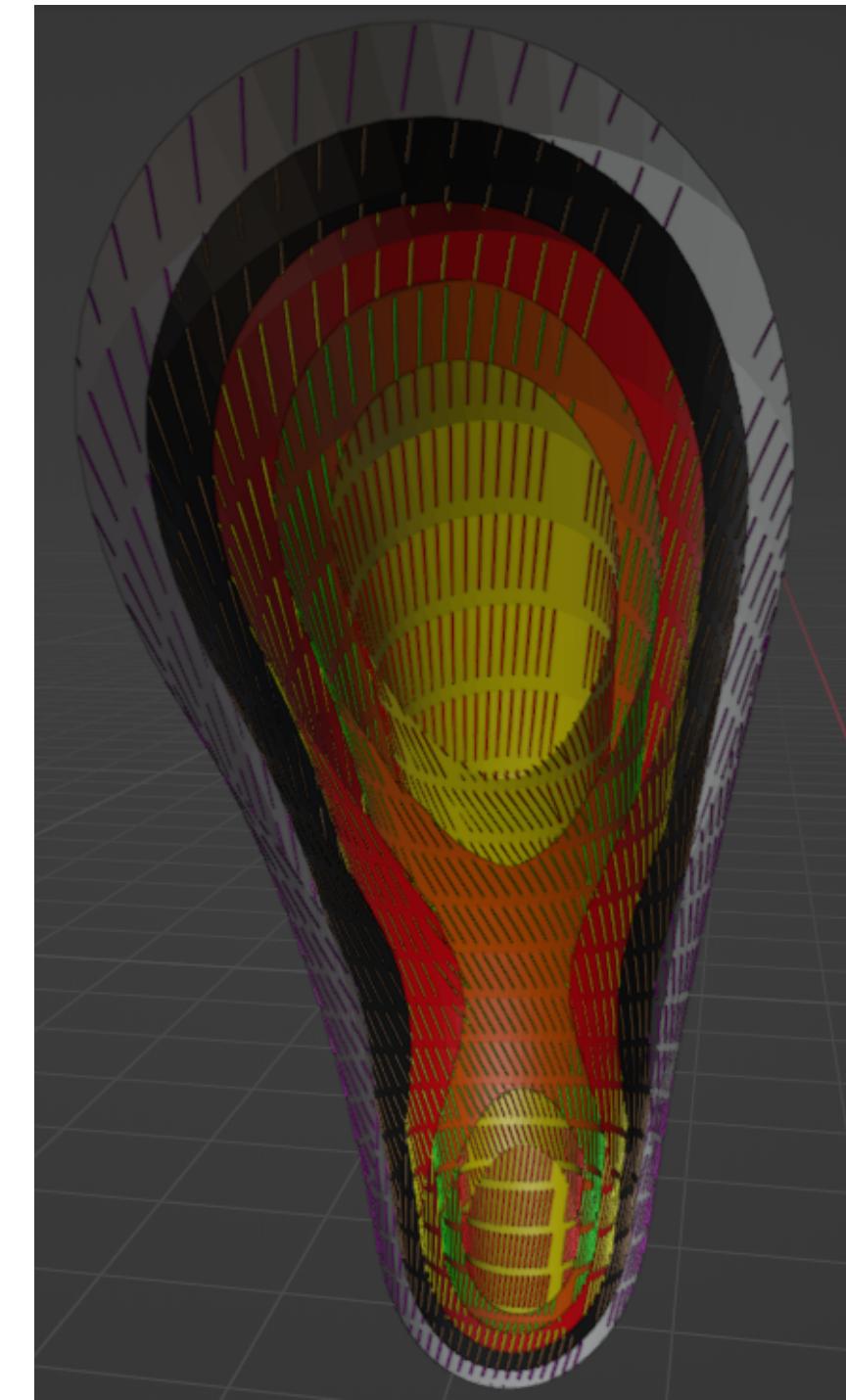
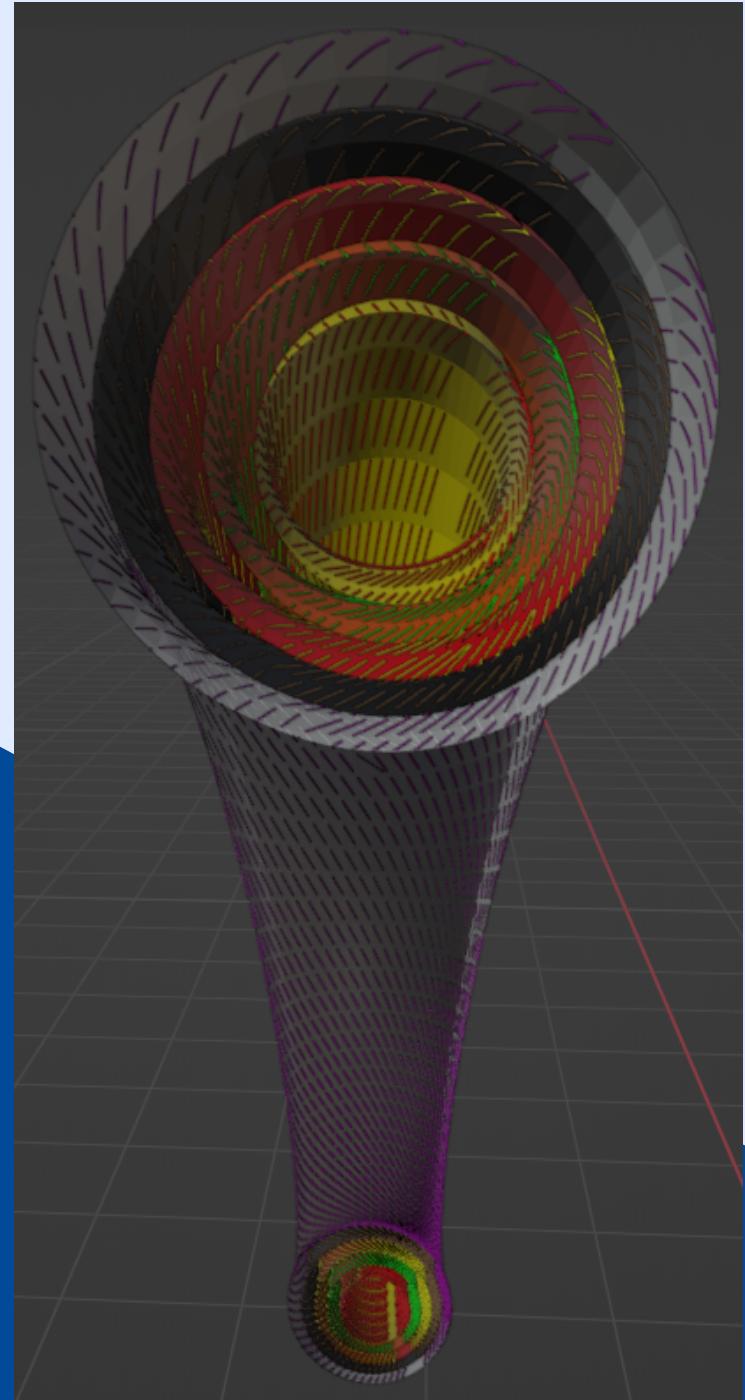
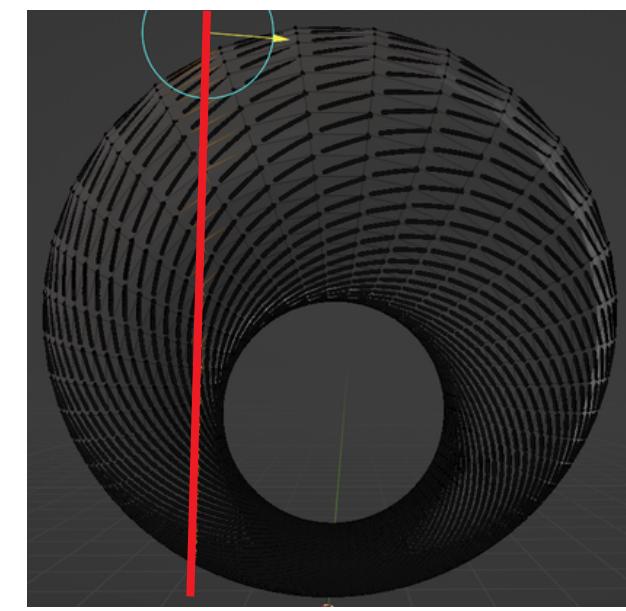
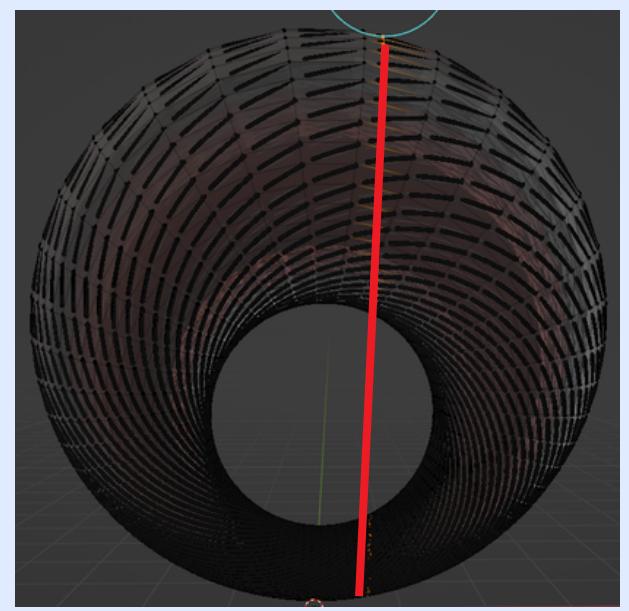


# Géodésiques





**taille des cyclides : 60x60**

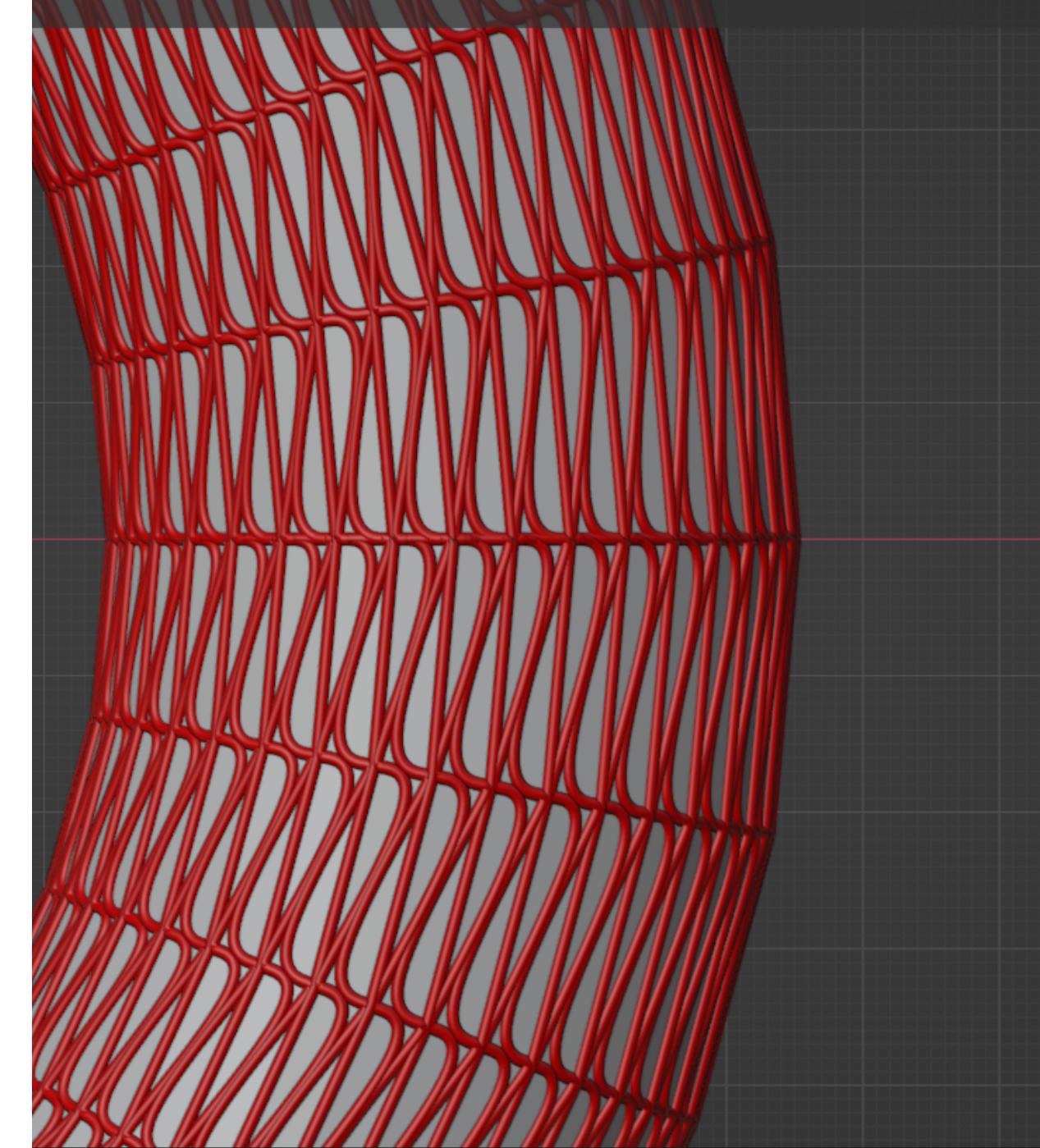
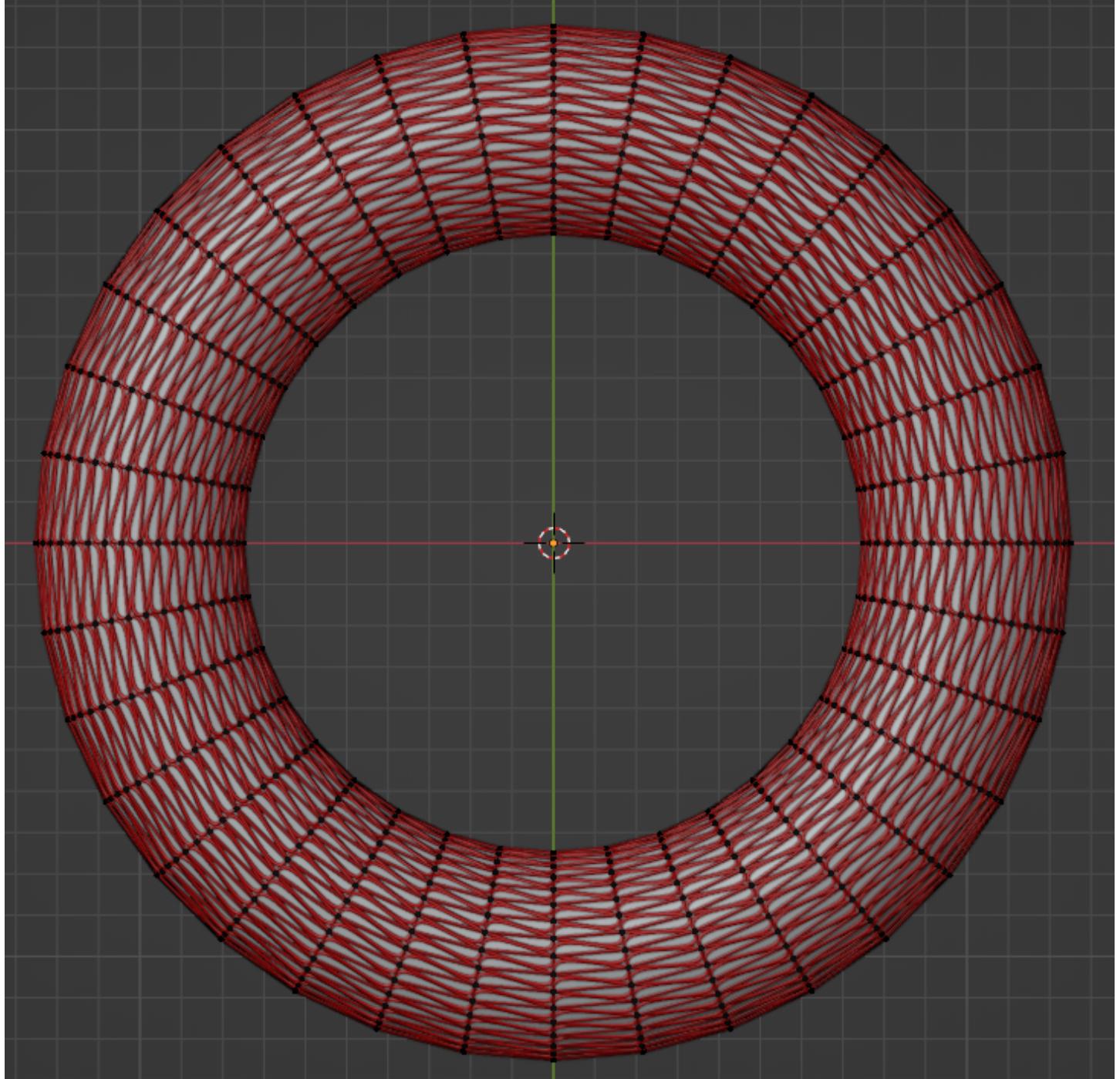


**taille des cyclides : 60x60**

# Modifications et optimisations : Impacts sur les performances



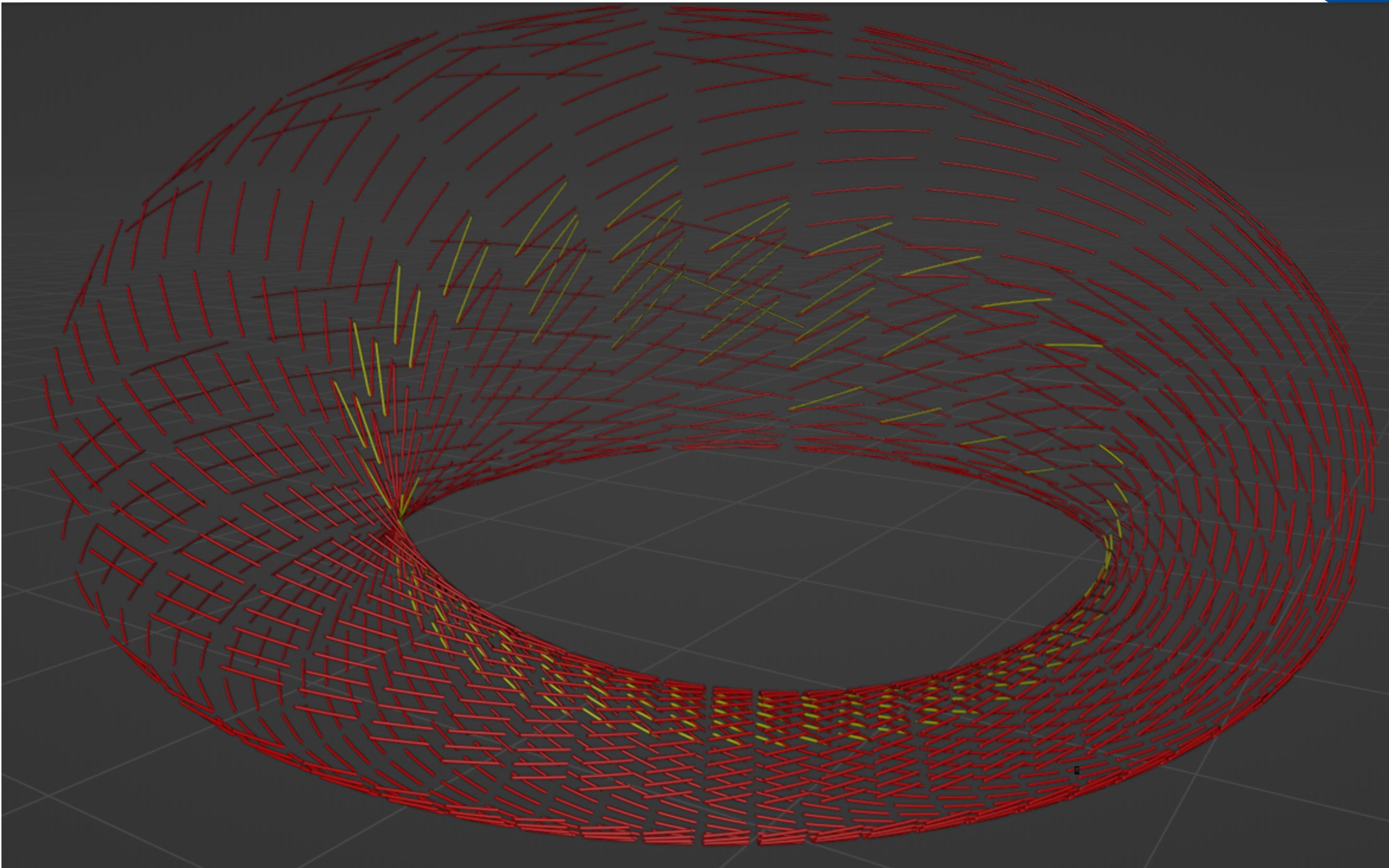
# Géodésique



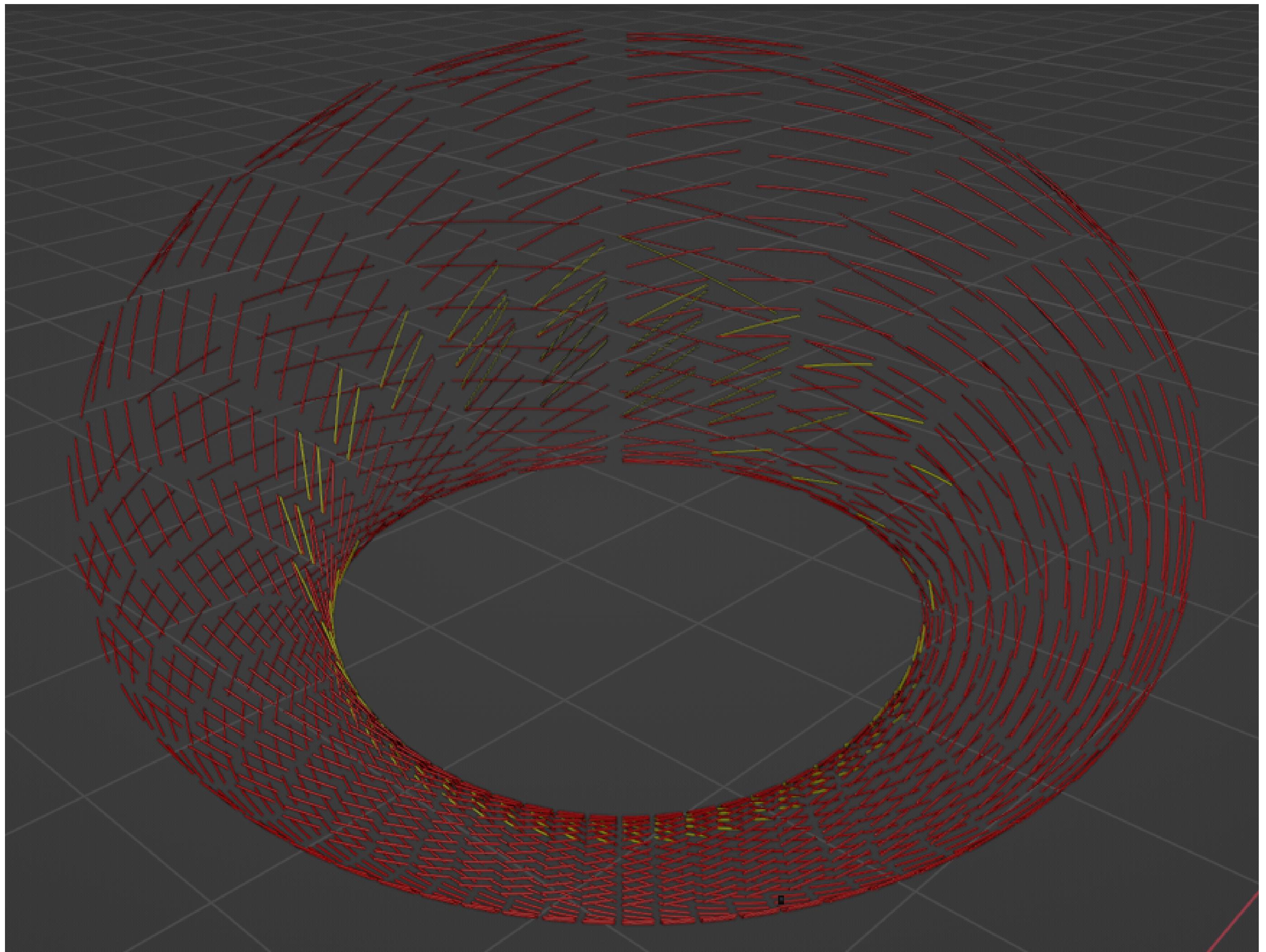
# Géodésique

► ↗ Geodesic.2577	↗	► ↗ Geodesic.097	↗	► ↗ Geodesic.1175	↗
► ↗ Geodesic.2578	↗	► ↗ Geodesic.098	↗	► ↗ Geodesic.1176	↗
► ↗ Geodesic.2579	↗	► ↗ Geodesic.099	↗	► ↗ Geodesic.1177	↗
► ↗ Geodesic.2580	↗	► ↗ Geodesic.100	↗	► ↗ Geodesic.1178	↗
► ↗ Geodesic.2581	↗	► ↗ Geodesic.101	↗	► ↗ Geodesic.1179	↗
► ↗ Geodesic.2582	↗	► ↗ Geodesic.102	↗	► ↗ Geodesic.1180	↗
► ↗ Geodesic.2583	↗	► ↗ Geodesic.103	↗	► ↗ Geodesic.1181	↗
► ↗ Geodesic.2584	↗	► ↗ Geodesic.104	↗	► ↗ Geodesic.1182	↗
► ↗ Geodesic.2585	↗	► ↗ Geodesic.105	↗	► ↗ Geodesic.1183	↗
► ↗ Geodesic.2586	↗	► ↗ Geodesic.106	↗	► ↗ Geodesic.1184	↗
► ↗ Geodesic.2587	↗	► ↗ Geodesic.107	↗	► ↗ Geodesic.1185	↗
► ↗ Geodesic.2588	↗	💡 Light	💡	► ↗ Geodesic.1186	↗
► ↗ Geodesic.2589	↗			► ↗ Geodesic.1187	↗
► ↗ Geodesic.2590	↗			► ↗ Geodesic.1188	↗
► ↗ Geodesic.2591	↗				
► ⚡ Torus.002	⚡	▼ Torus	▼	► ⚡ Torus	⚡

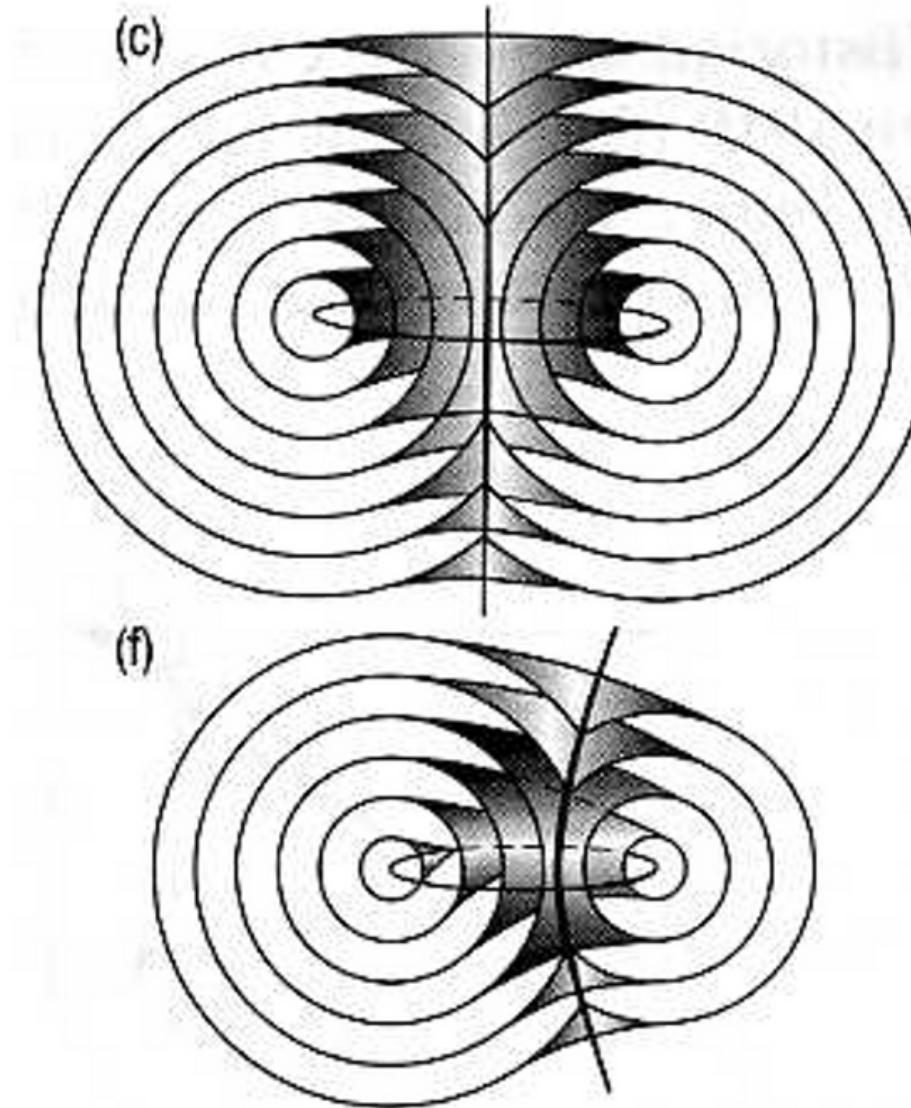
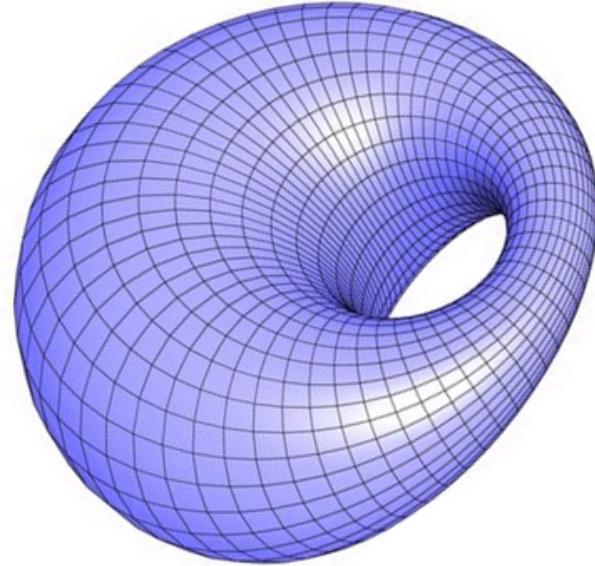
# DEMO



# DEMO



# Cyclide De Dupin



Axe  
et  
Cercle

Hyperbole  
et  
ellipse  
focale

Cyclide de Dupin

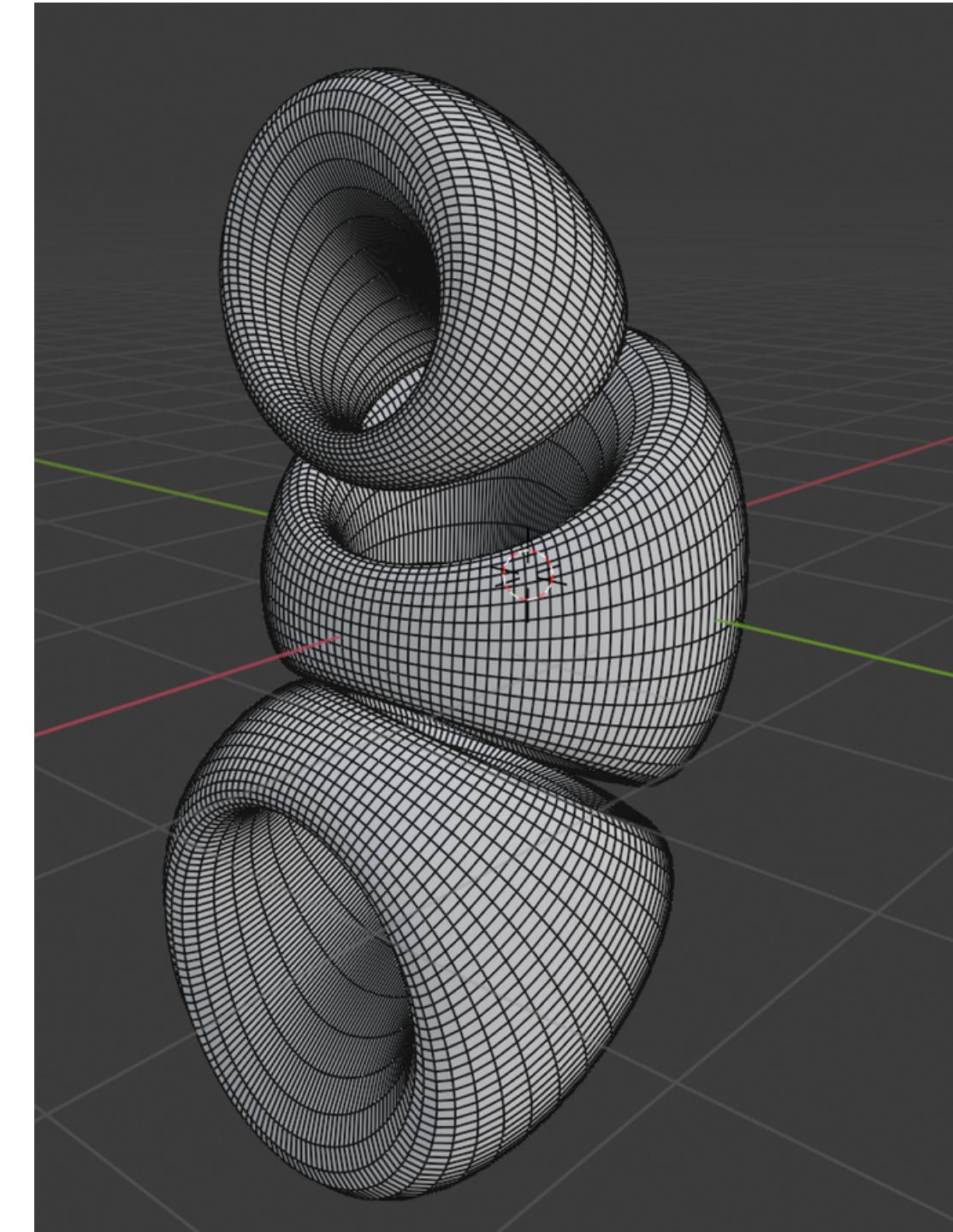
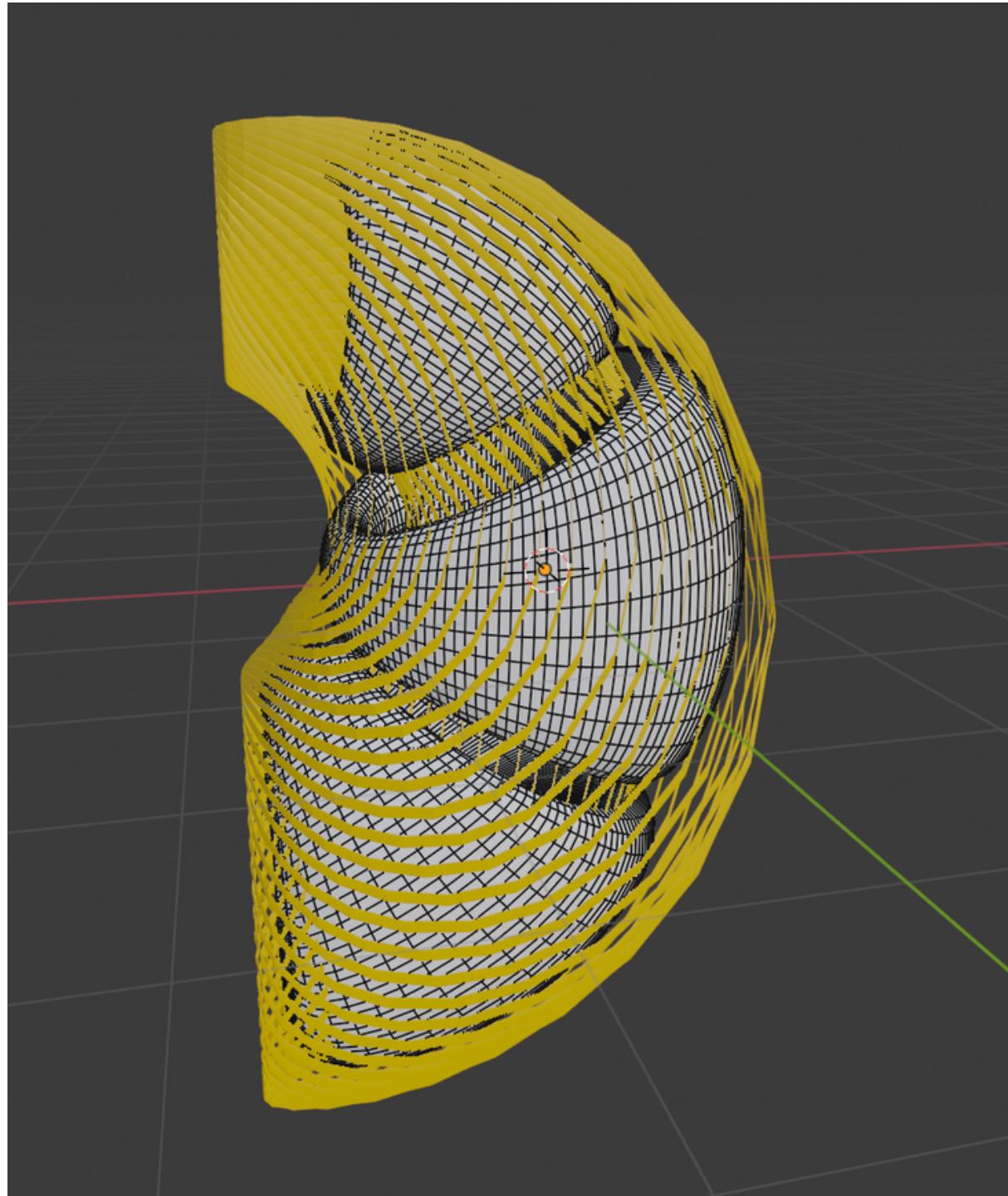
Inversion de centre O et de puissance k associe un point M à un point M'

$$\mathbf{OM} = k \times \mathbf{OM}' \quad / \quad |OM|^2$$

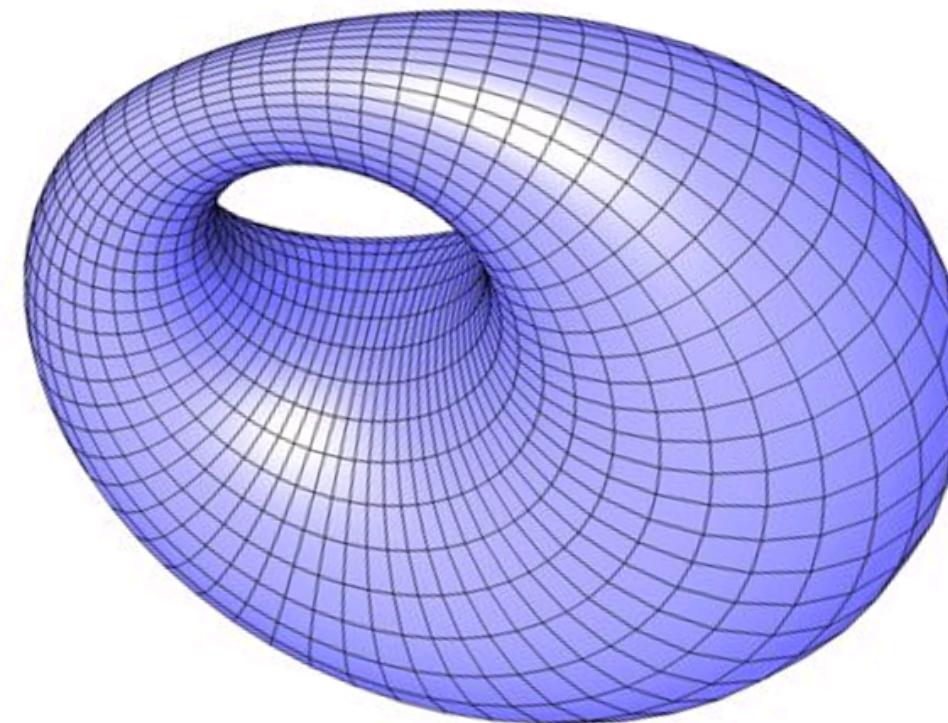
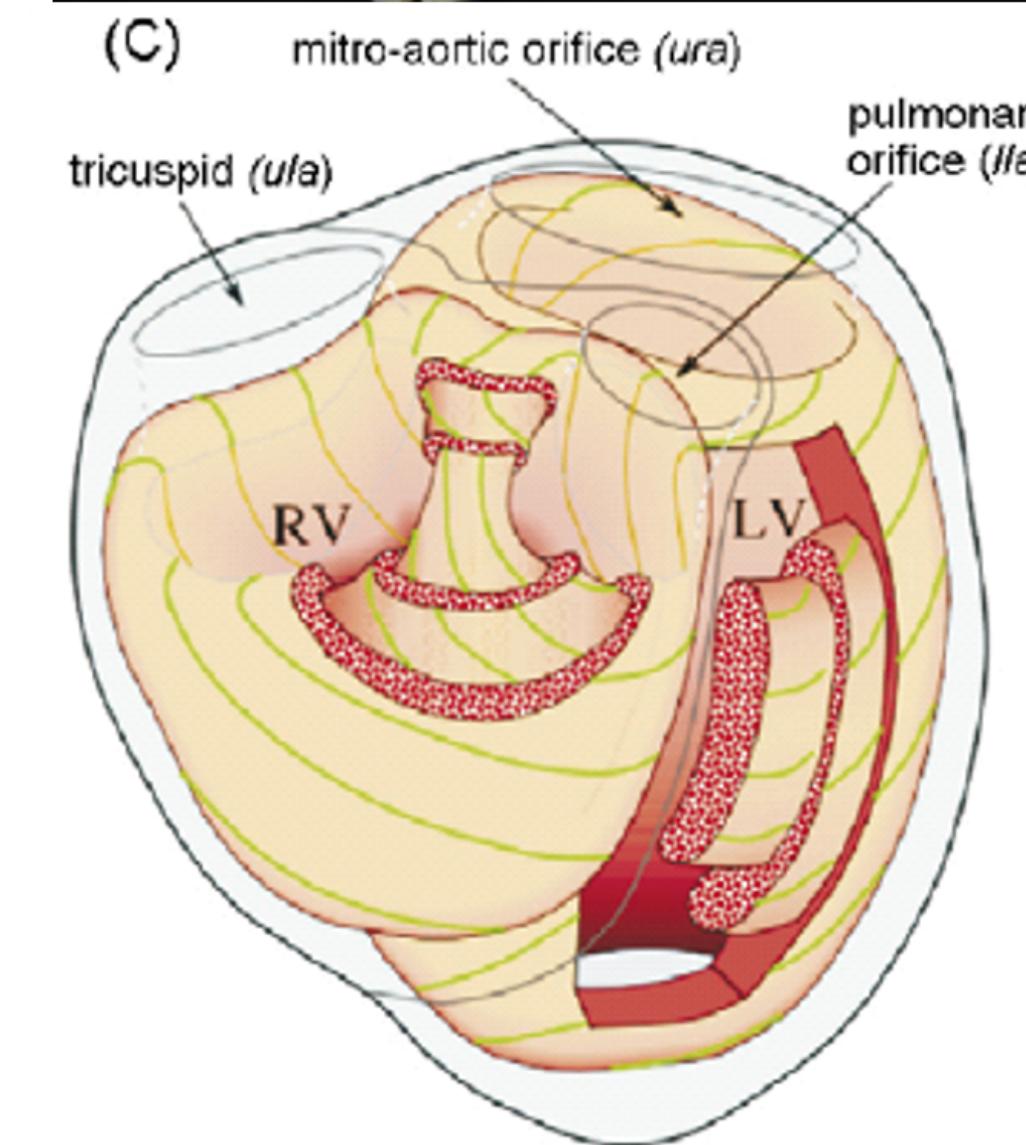
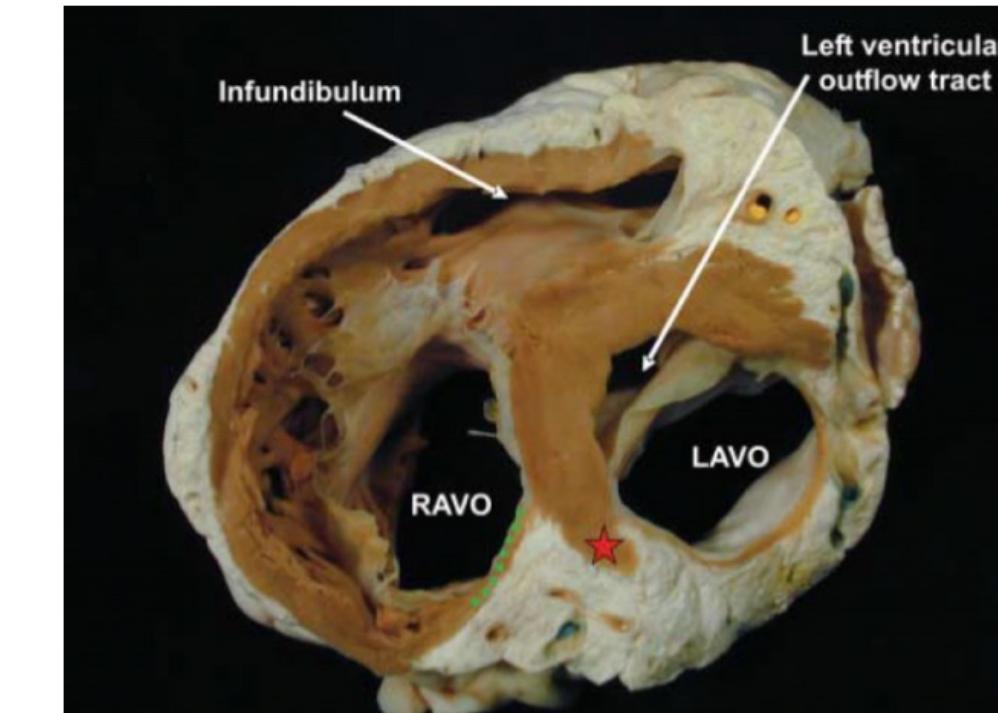
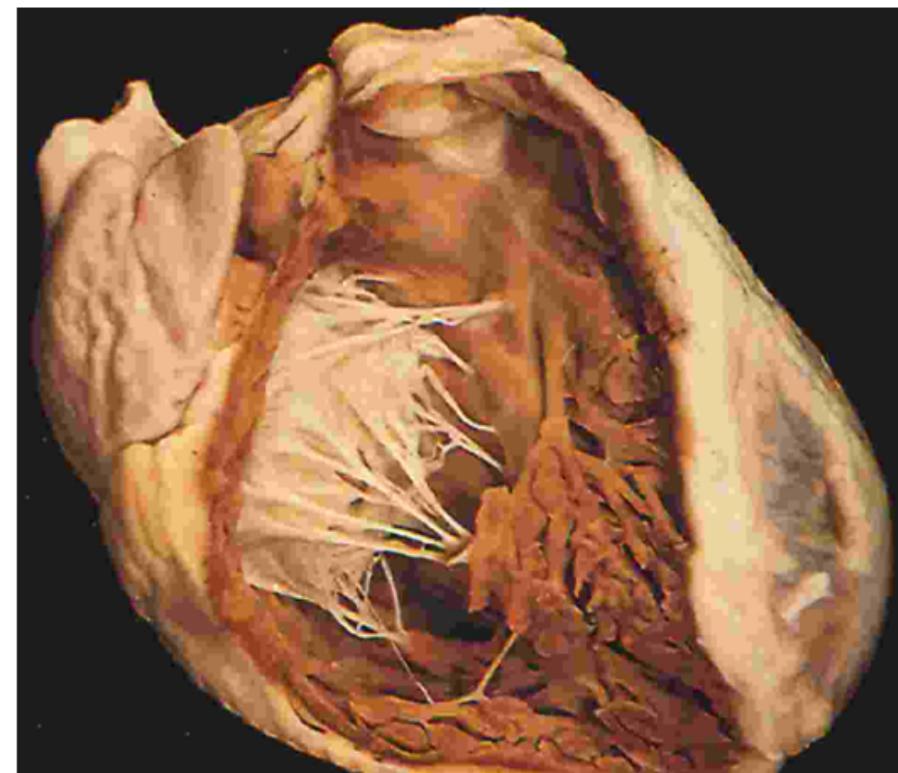
Bouligand Y, 2006

# Cyclide De Dupin

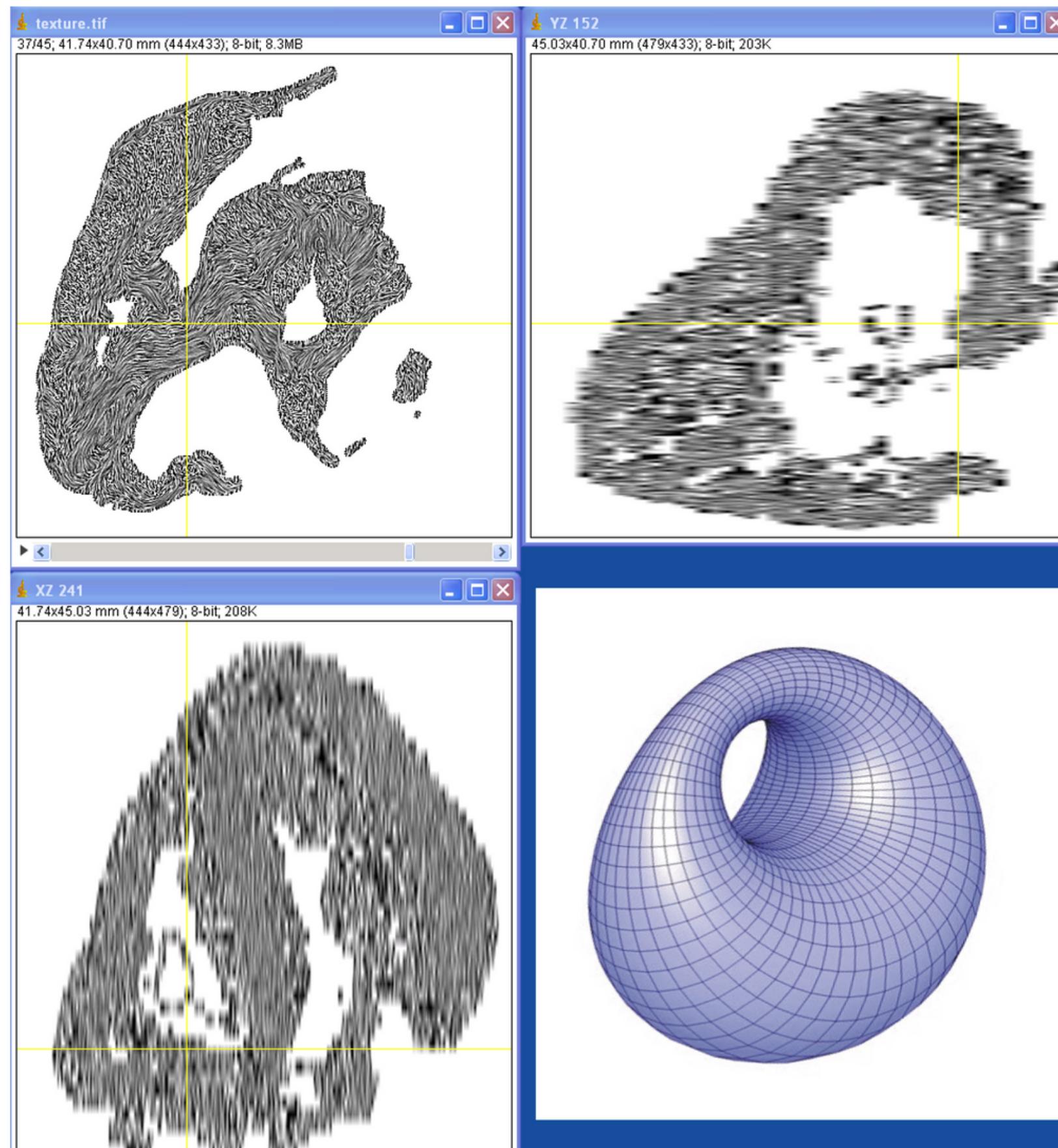
Représentation du ventricule droit sur Blender



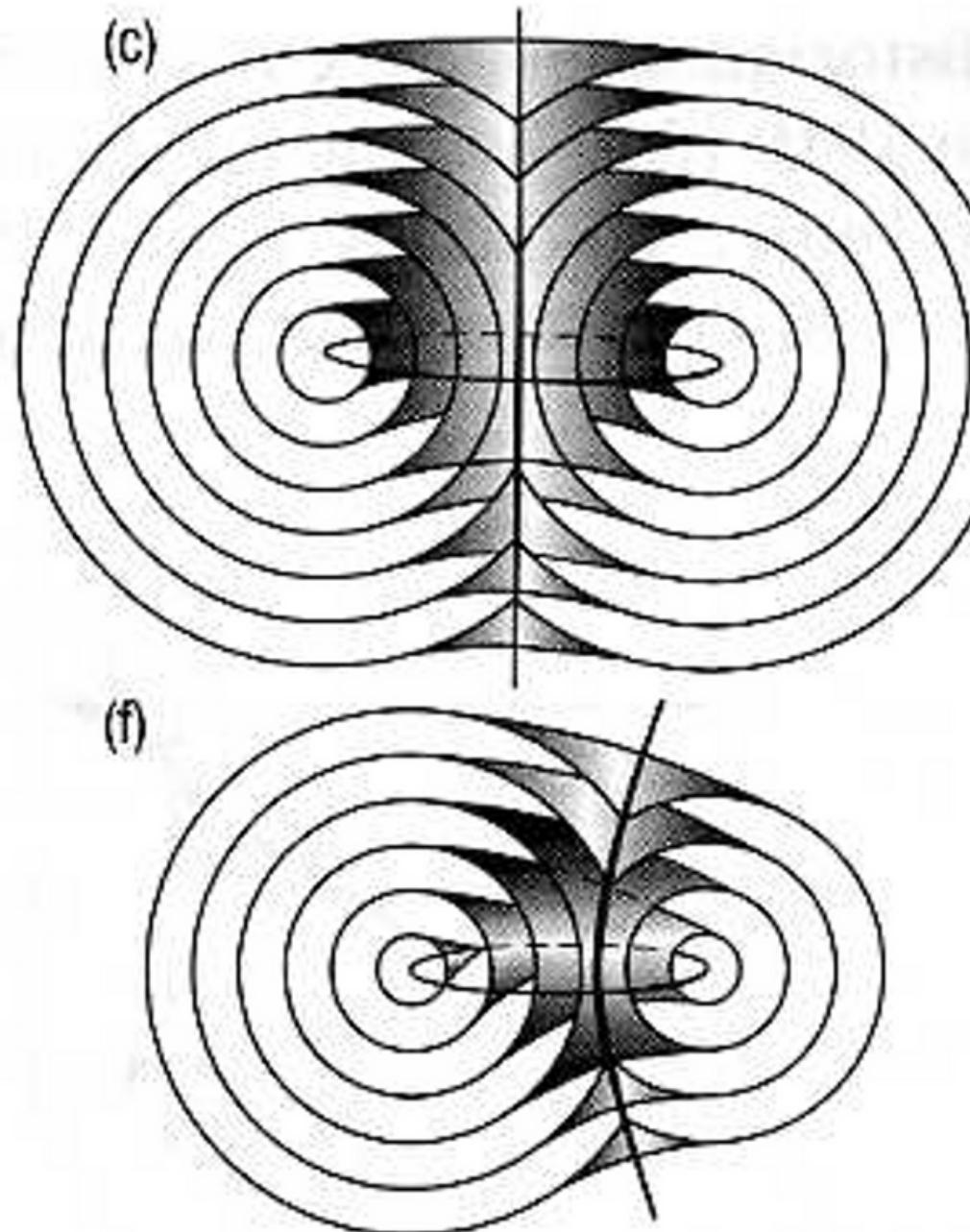
# Cyclide De Dupin



# Cyclide De Dupin



# Conclusion



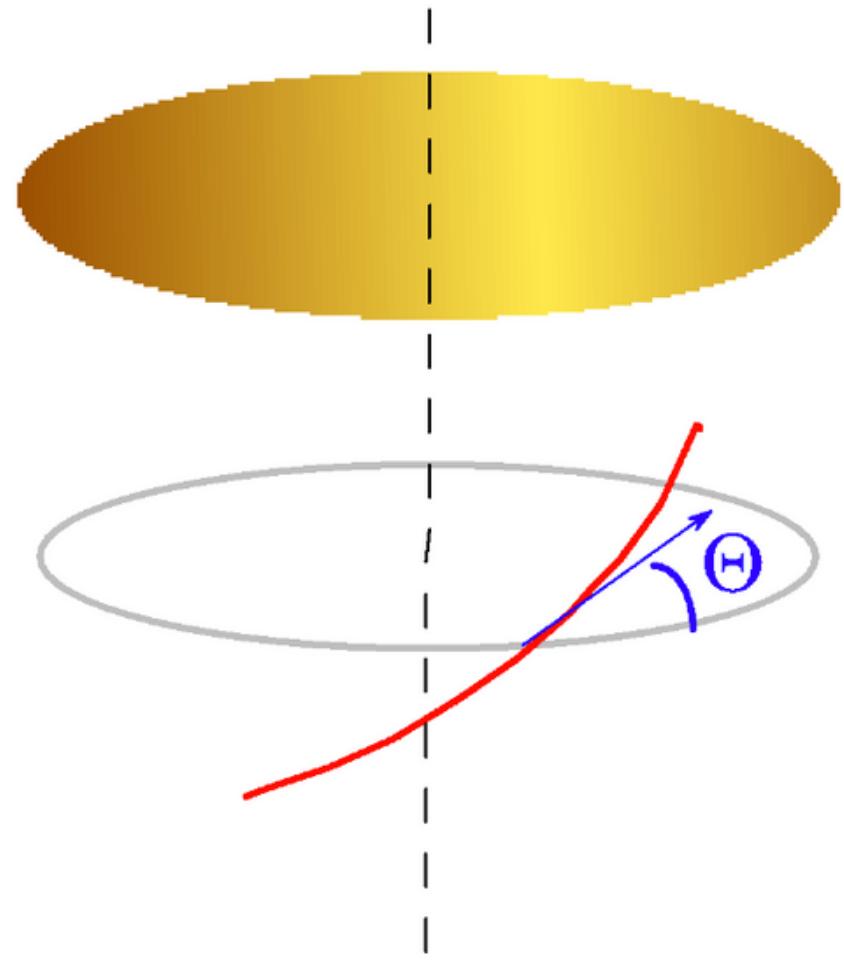
Axe  
et  
Cercle

Hyperbole  
et  
ellipse  
focale

Tout cône dont le sommet se situe sur une conique et dont les génératrices s'appuient sur l'autre conique est de révolution

# Conclusion

Miracle des structures de révolution



Propriété de Clairaut :  $r \cos \theta = C$

# Conclusion

Donc, si “Streeter vrai”, alors  $r \cos \theta$  reste constant le long d ’une trajectoire dans le ventricule gauche.

Miracle des données expérimentales : Notons  $\tau$  le vecteur tangent à une trajectoire :  $\tau = (\tau_x, \tau_y, \tau_z)$ .  
On a immédiatement

$$r \cos \theta = |x \tau_y - y \tau_x|$$

Or, les données expérimentales fournissent facilement les valeurs de  $x \tau_y - y \tau_x$ .

# Cyclide De Dupin

Représentation du ventricule droit sur Blender

