

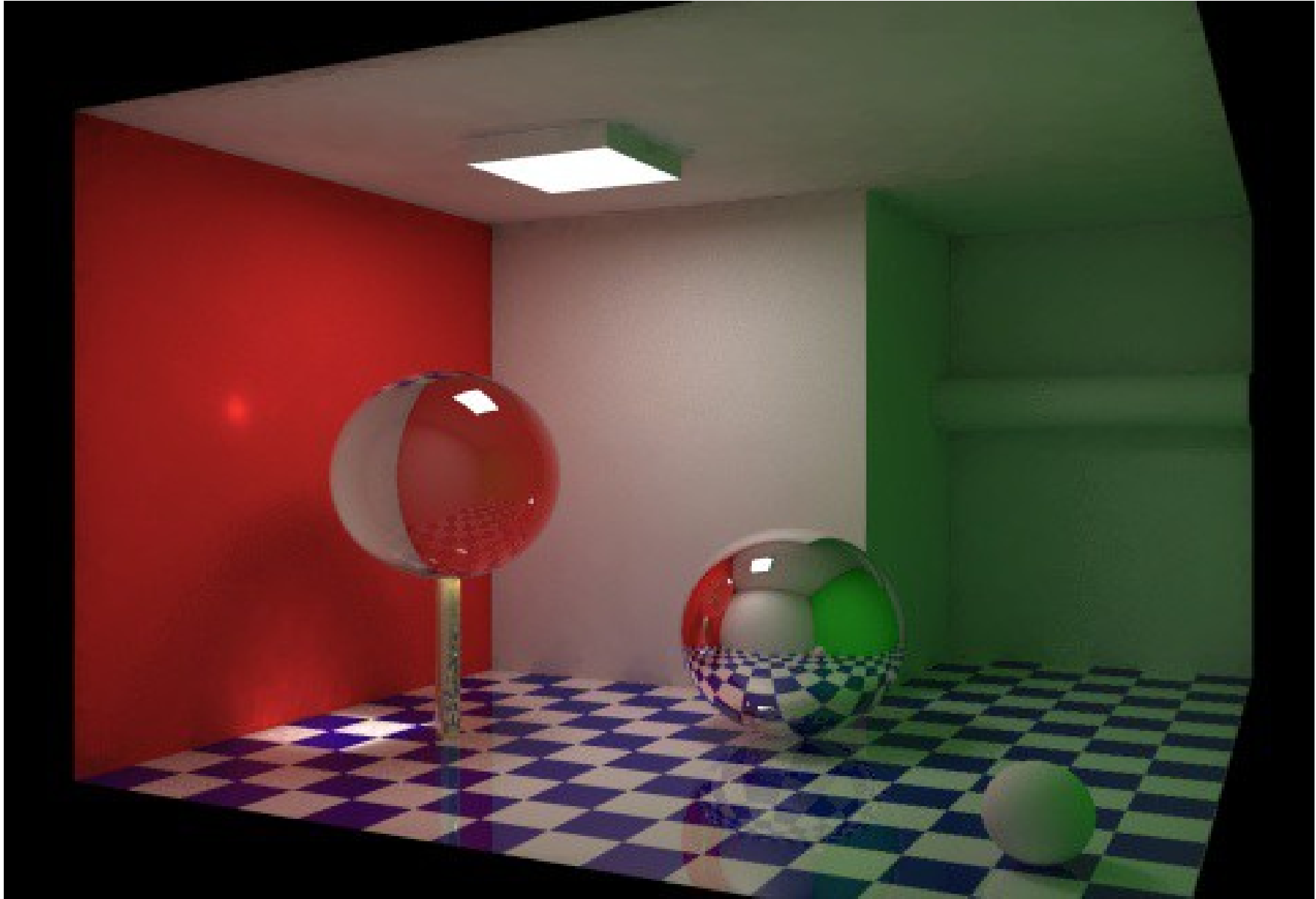
# Lighting Models

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Spring 2014  
University of Tartu

# Lighting Models

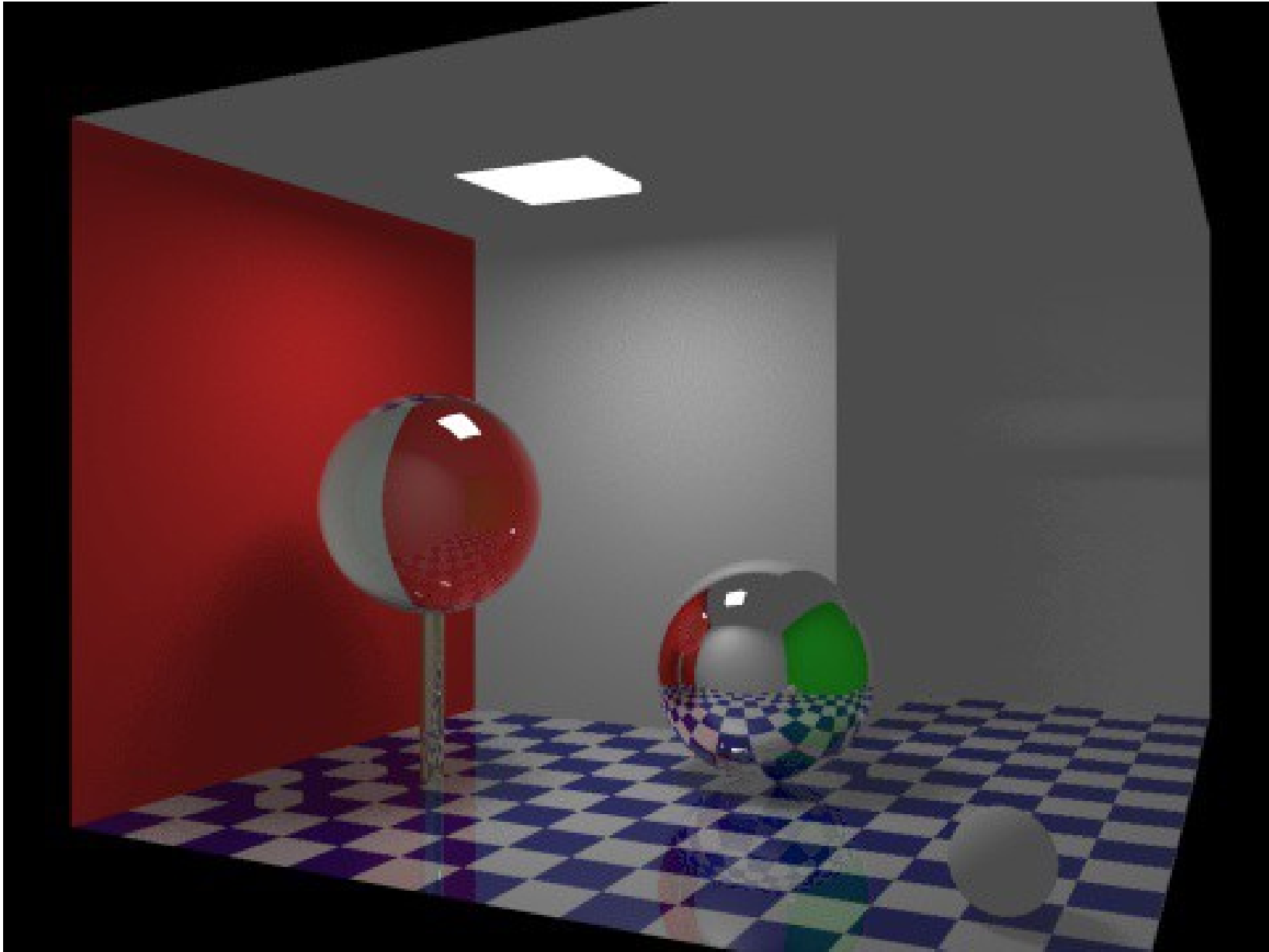
- Local lighting models
- Global lighting models

# Global lighting

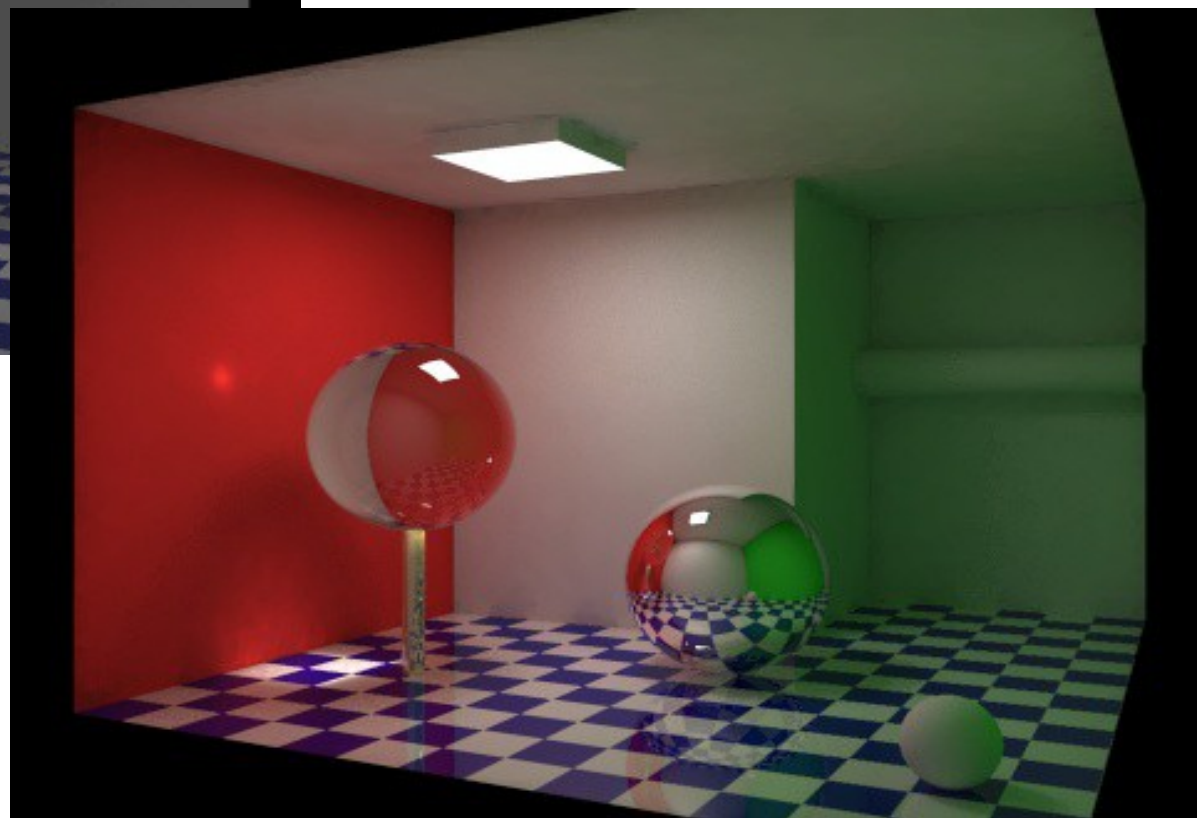
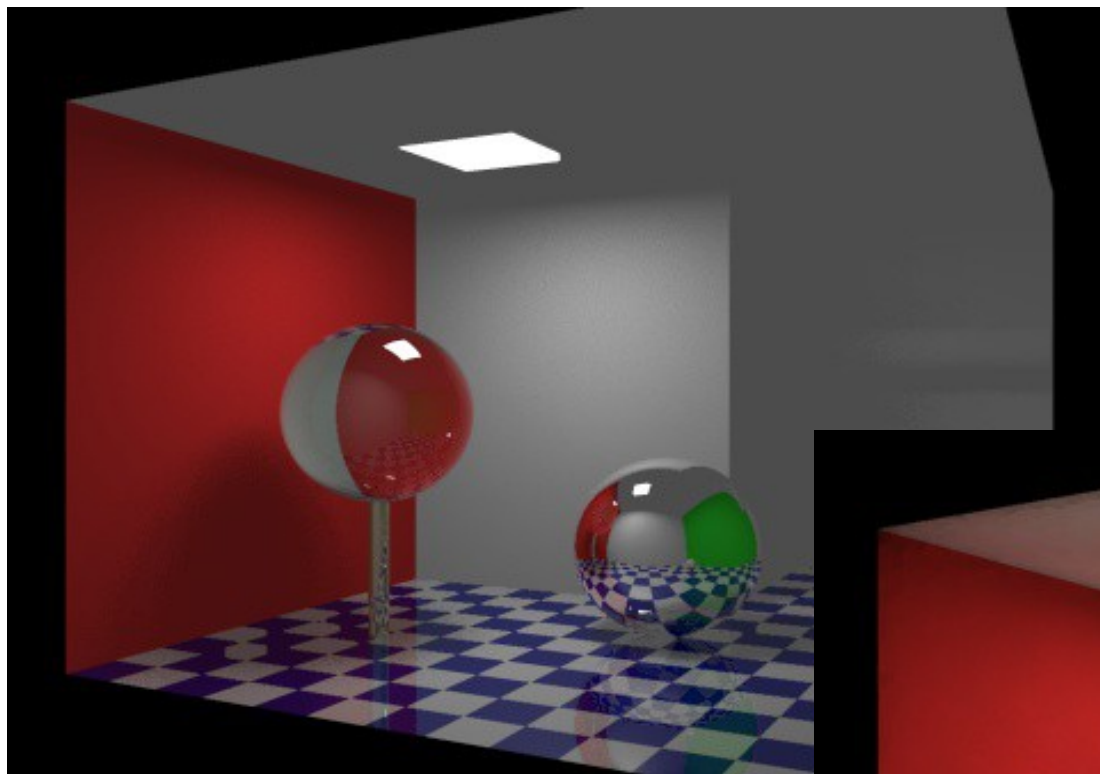


[https://en.wikipedia.org/wiki/File:Global\\_illumination.JPG](https://en.wikipedia.org/wiki/File:Global_illumination.JPG)

# Local lightning



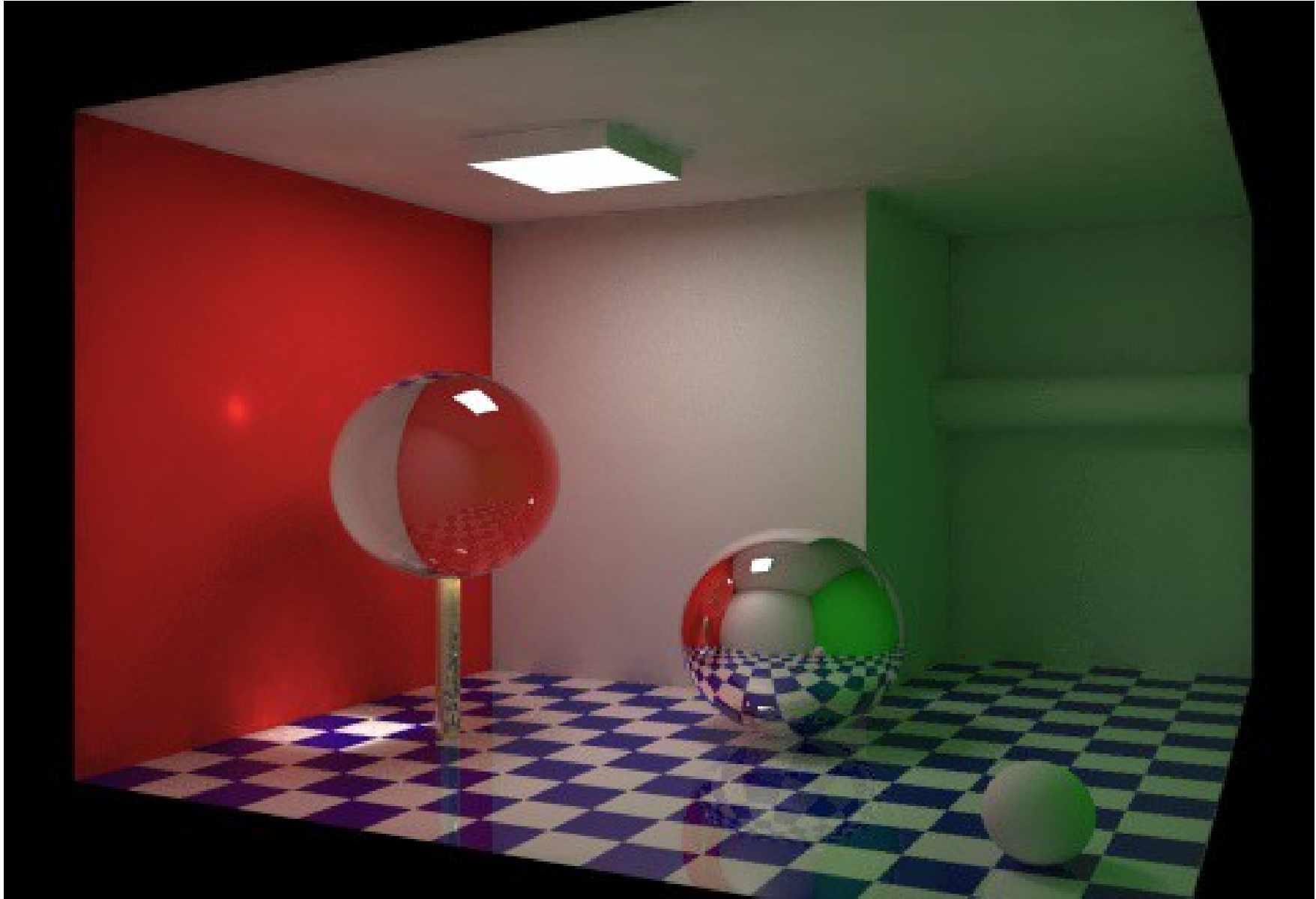
# Local vs Global



# Local vs Global

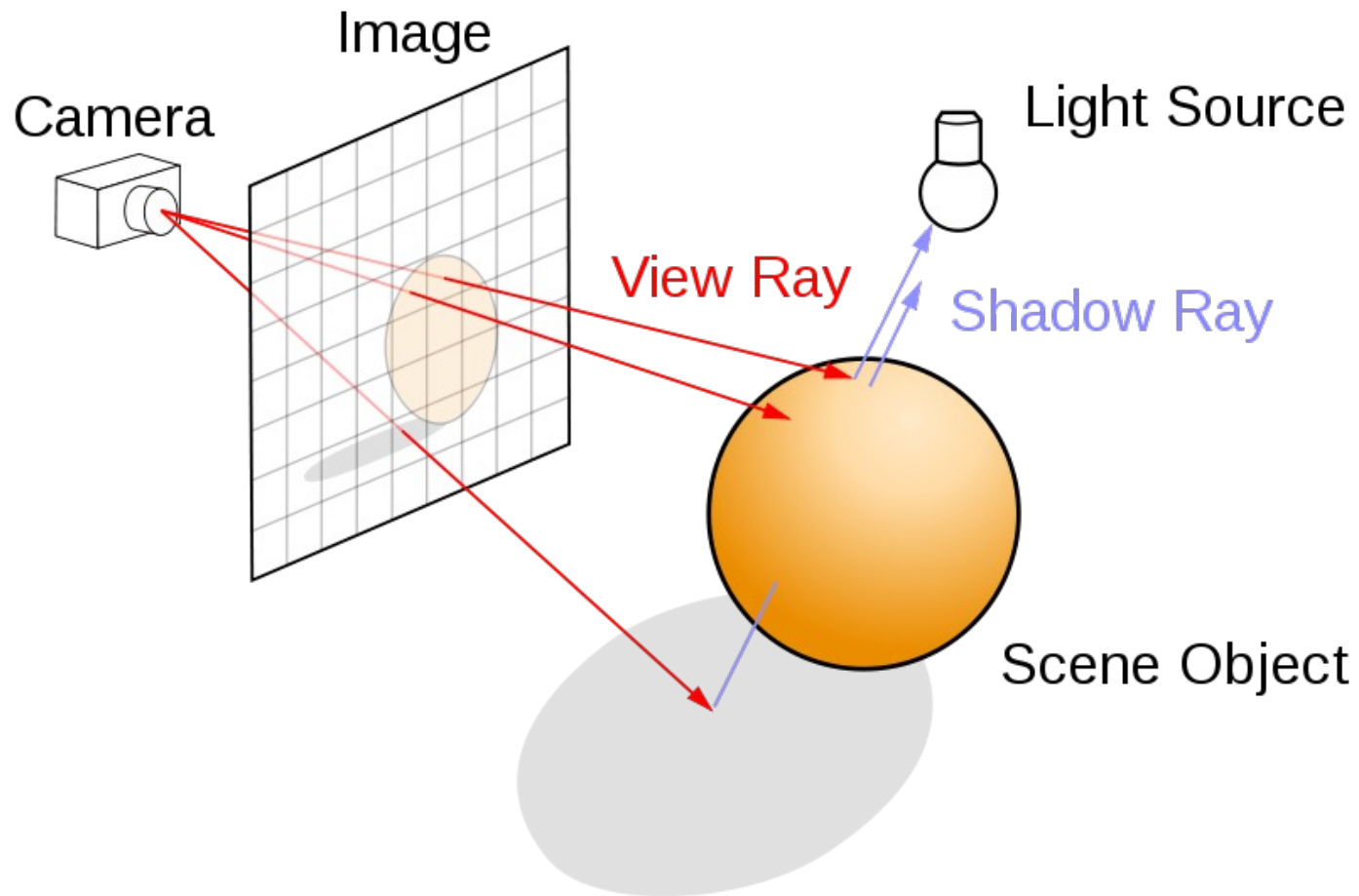
- Global illumination needs more processing power
- More realistic with global illumination
- = not fast, but accurate

# Global lighting



[https://en.wikipedia.org/wiki/File:Global\\_illumination.JPG](https://en.wikipedia.org/wiki/File:Global_illumination.JPG)

# Ray tracing





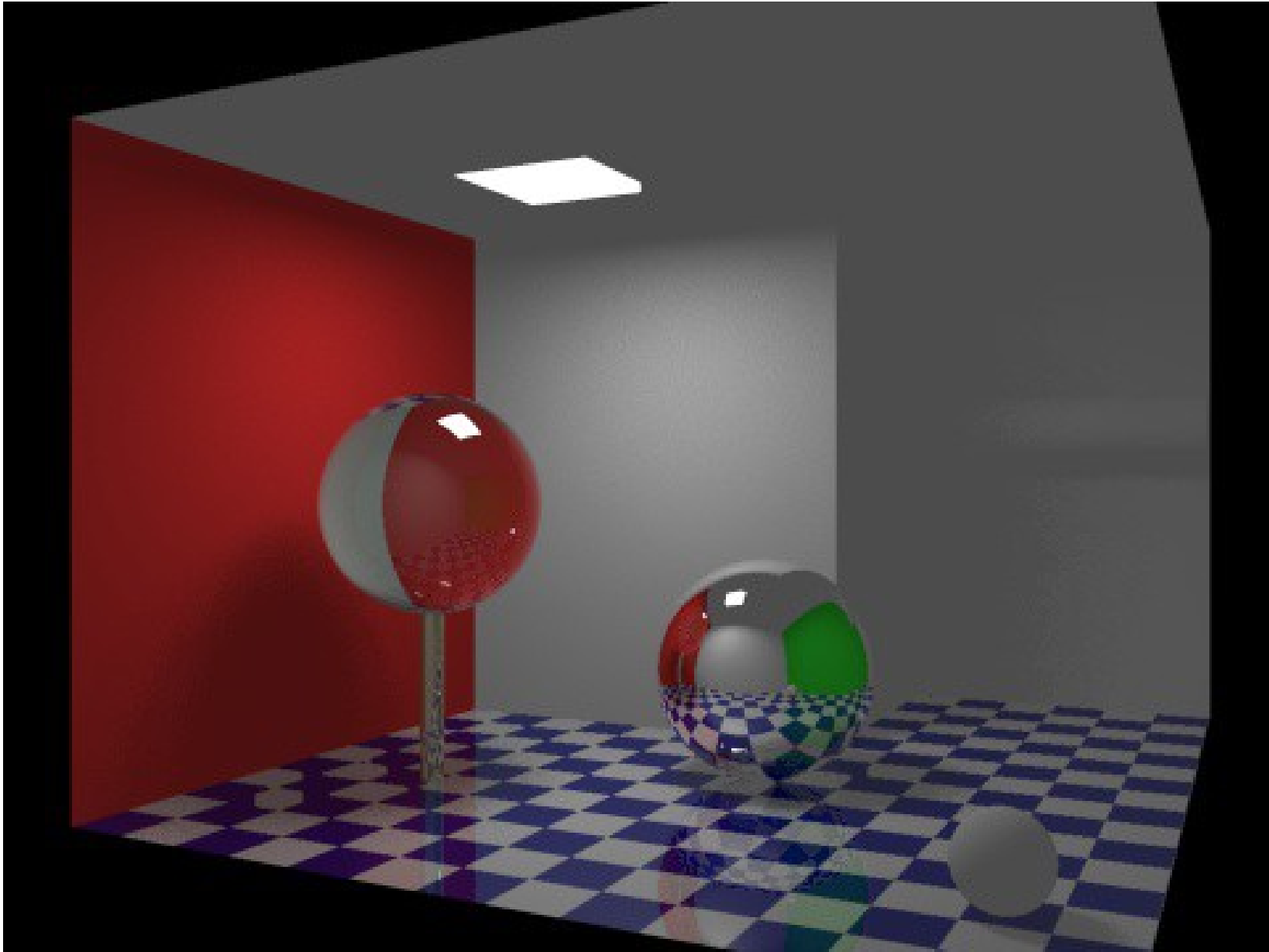
# Ray tracing

- <http://www.pcper.com/reviews/Graphics-Cards/Ray-Tracing-and-Gaming-Quake-4-Ray-Traced-Project/Quake-4-Ray-traced>

# Ray tracing



# Local lightning



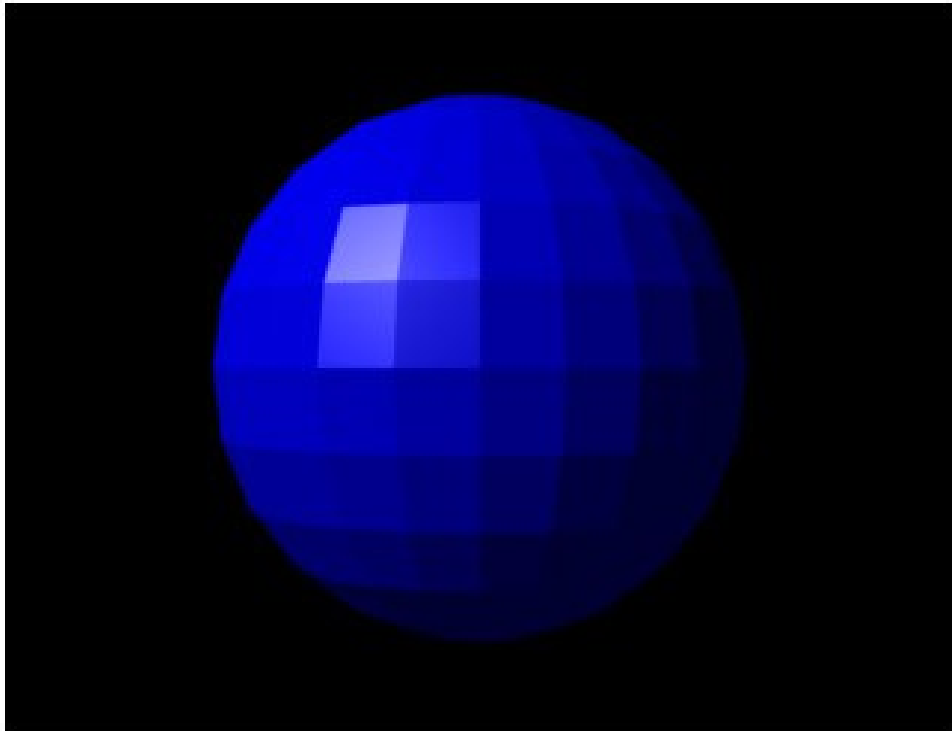
# Local Lighting

- Constant (flat)
- Smooth

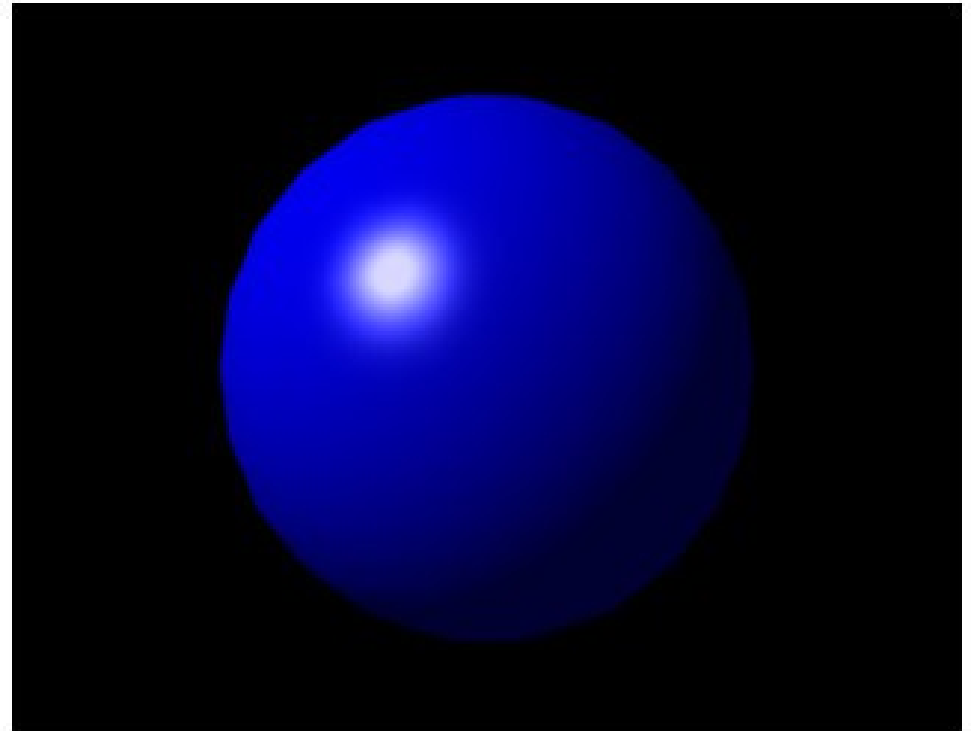
# Constant shading



# Smooth shading

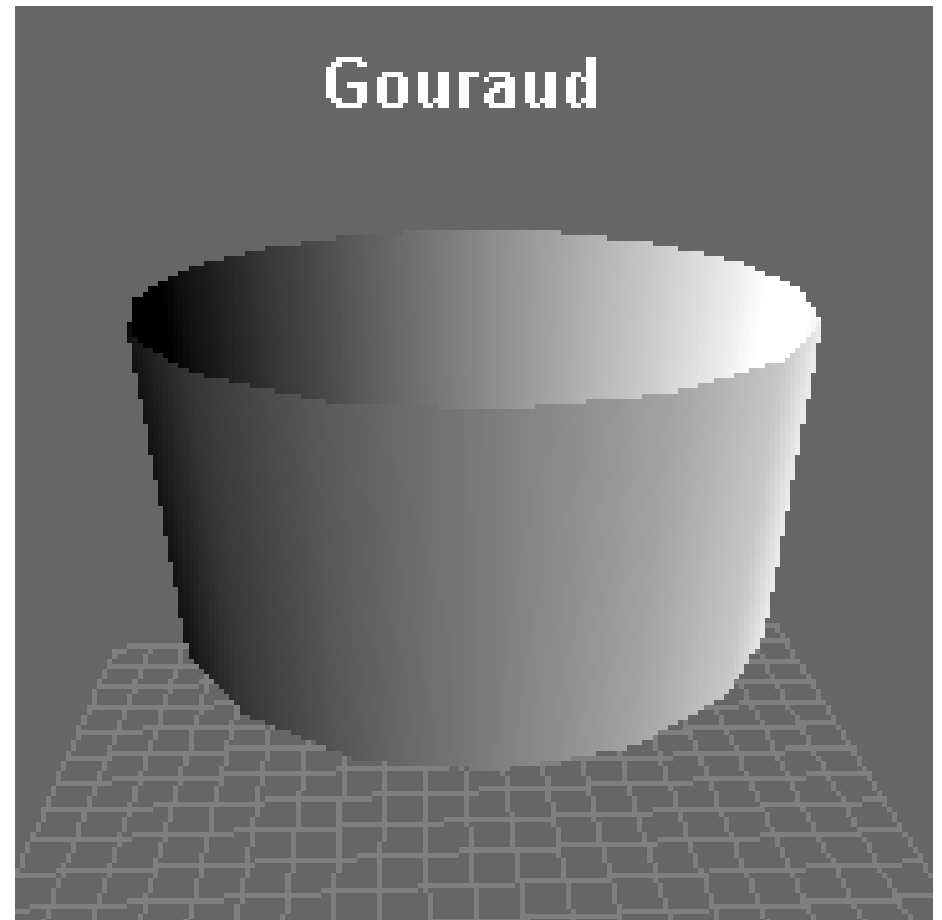
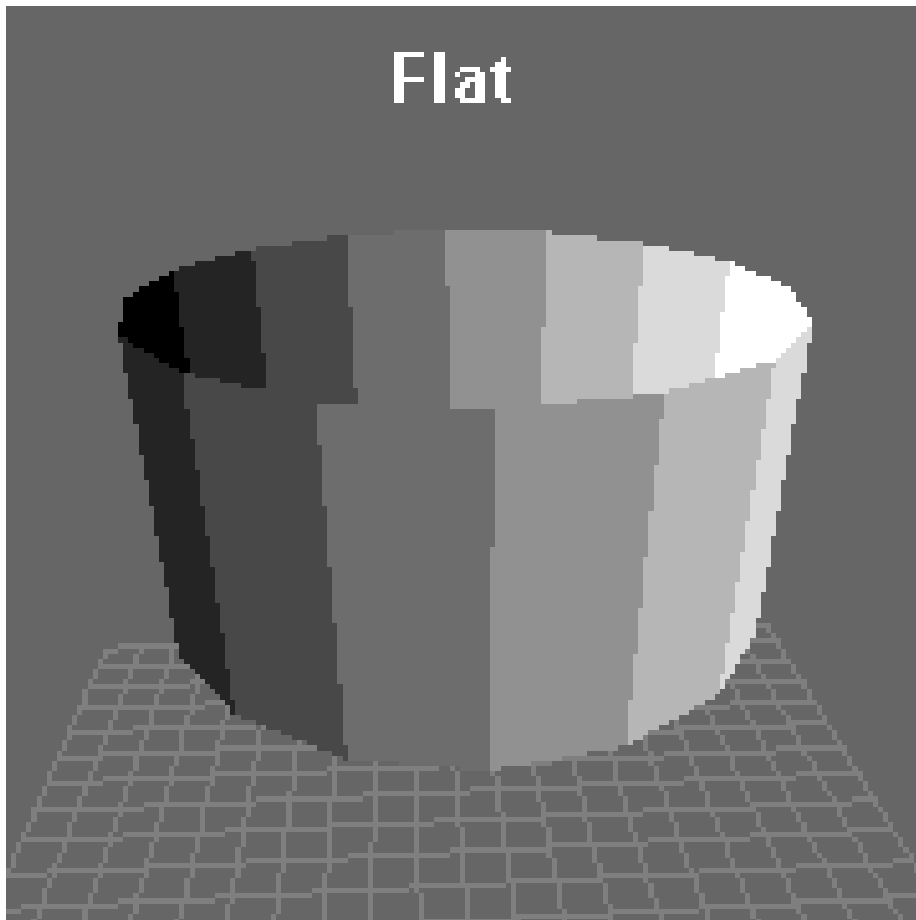


FLAT SHADING

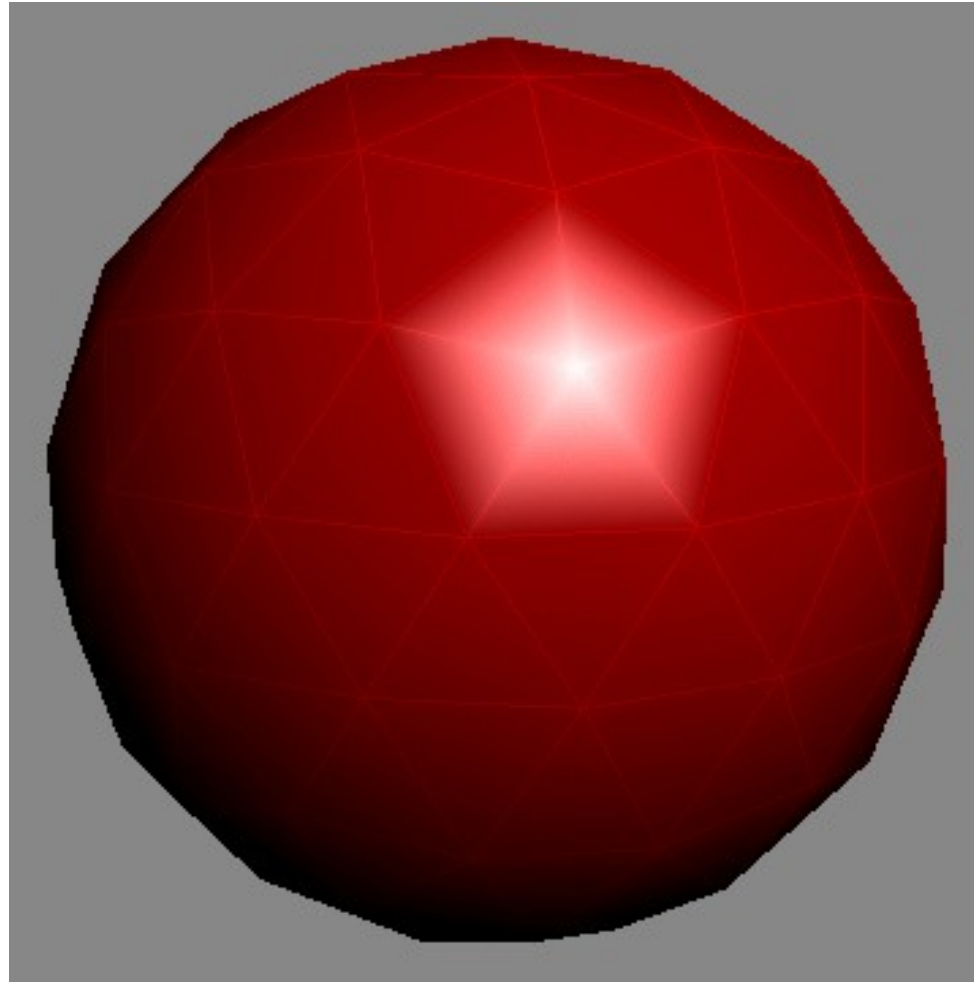


PHONG SHADING

# Gouraud shading



# Gouraud shading



[https://en.wikipedia.org/wiki/File:Gouraud\\_low\\_anim.gif](https://en.wikipedia.org/wiki/File:Gouraud_low_anim.gif)



# Gouraud shading

- Quake III uses gouraud shading for player and weapon, and optionally for the maps
- Star Wars: TIE Fighter, released in 1994

<http://www.giantbomb.com/gouraud-shading/3015-4864/games/>

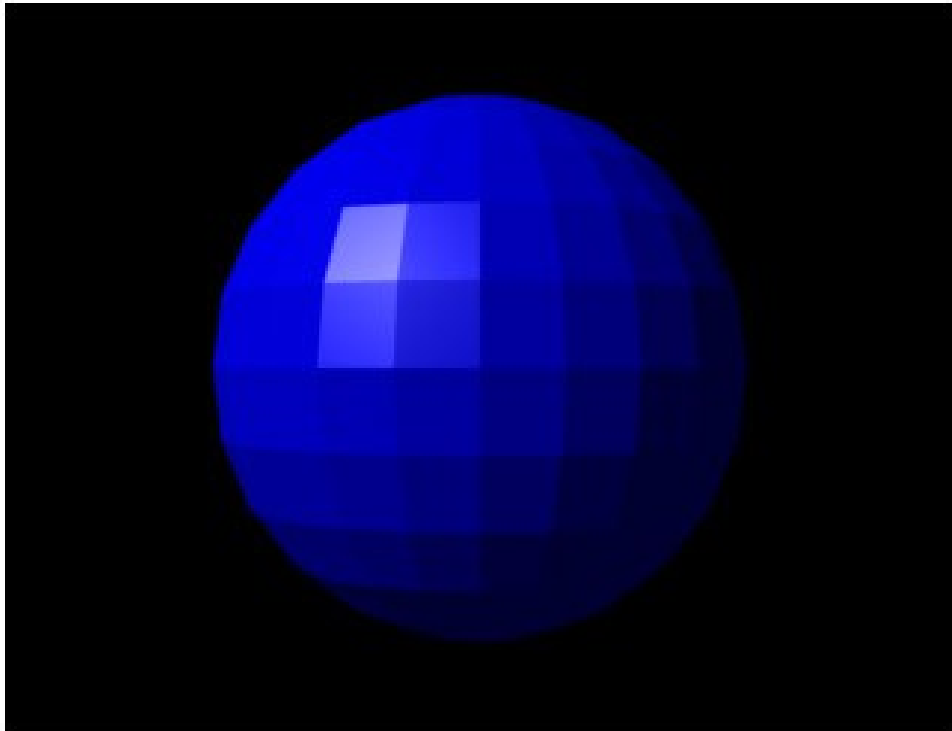
<http://www.edge-online.com/features/brief-history-3d/2/>

# Gouraud shading

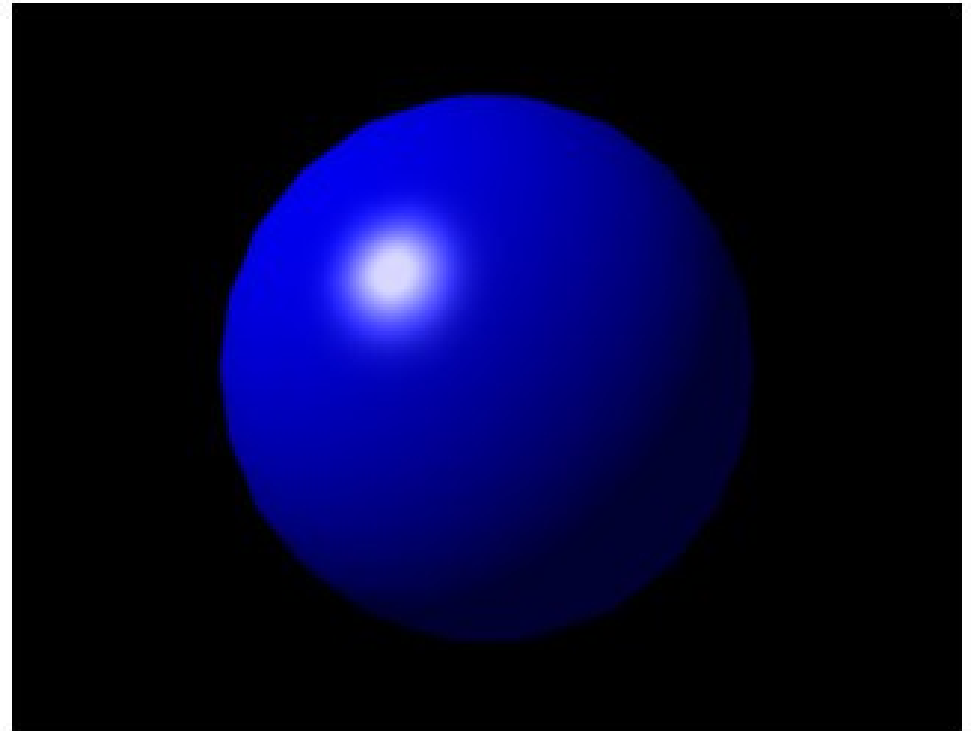


[https://en.wikipedia.org/wiki/File:Quake\\_III\\_Arena\\_q3dm0.png](https://en.wikipedia.org/wiki/File:Quake_III_Arena_q3dm0.png)

# Phong shading



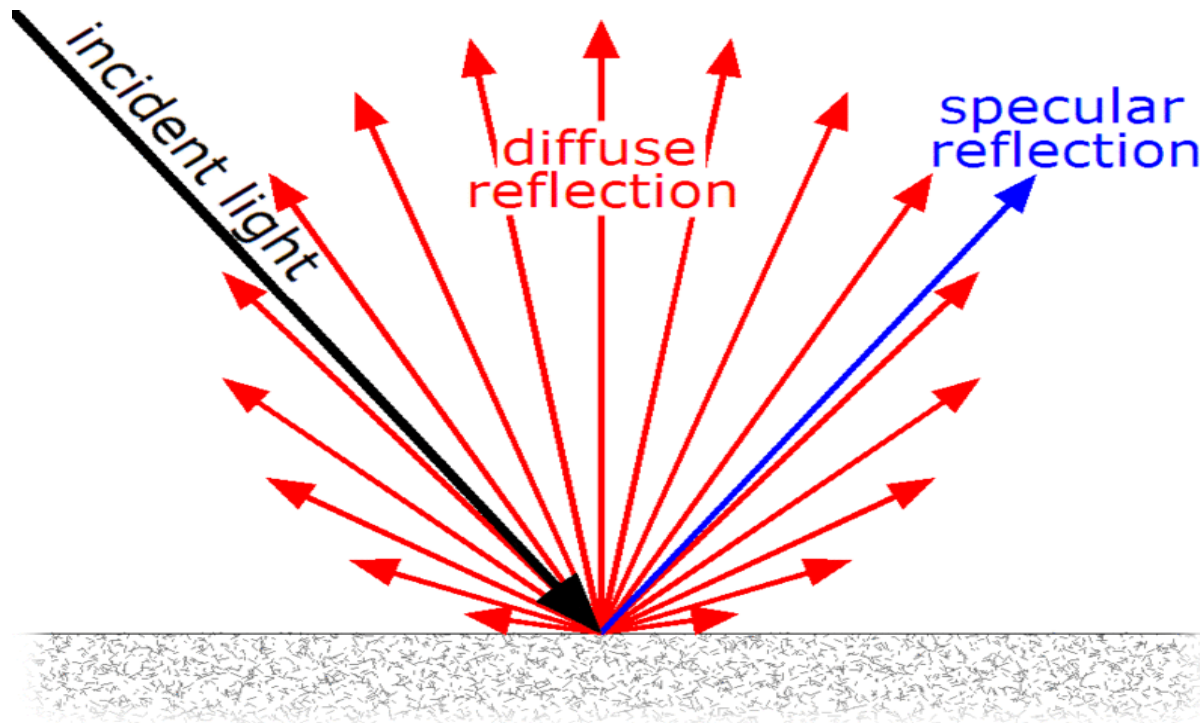
FLAT SHADING



PHONG SHADING

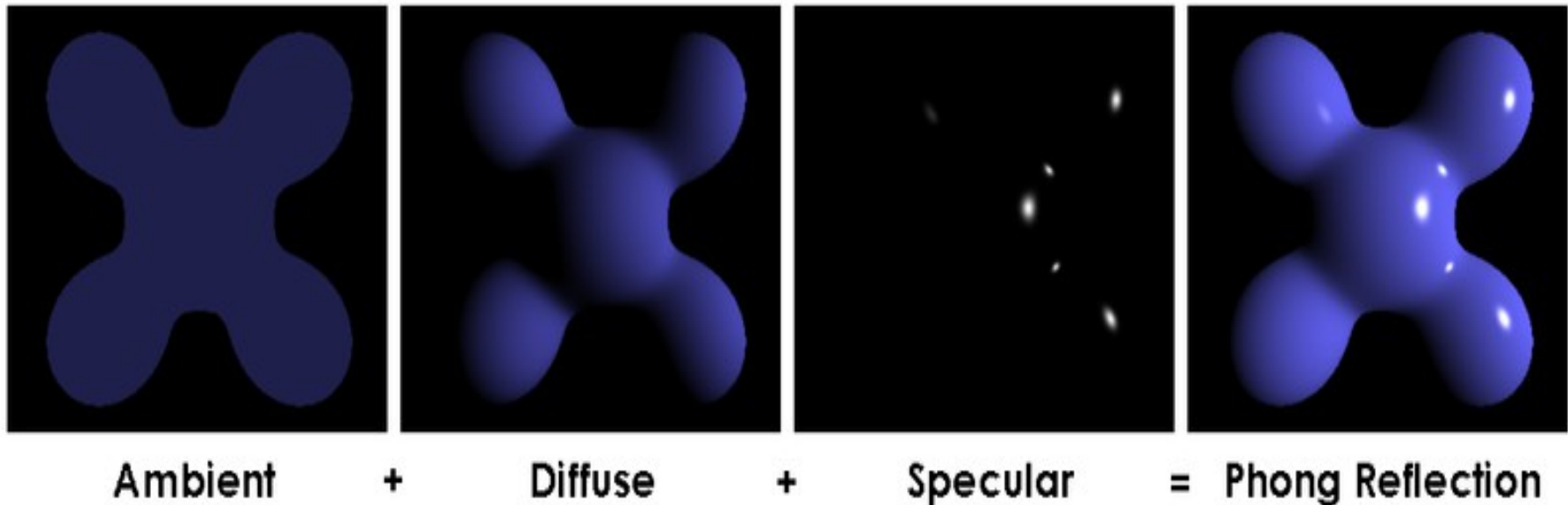
# Lambertian reflection model

- Model of diffuse reflection
- Reflection = normal (dot) light\_direction \* color \* intensity\_of\_light



# Phong reflection model

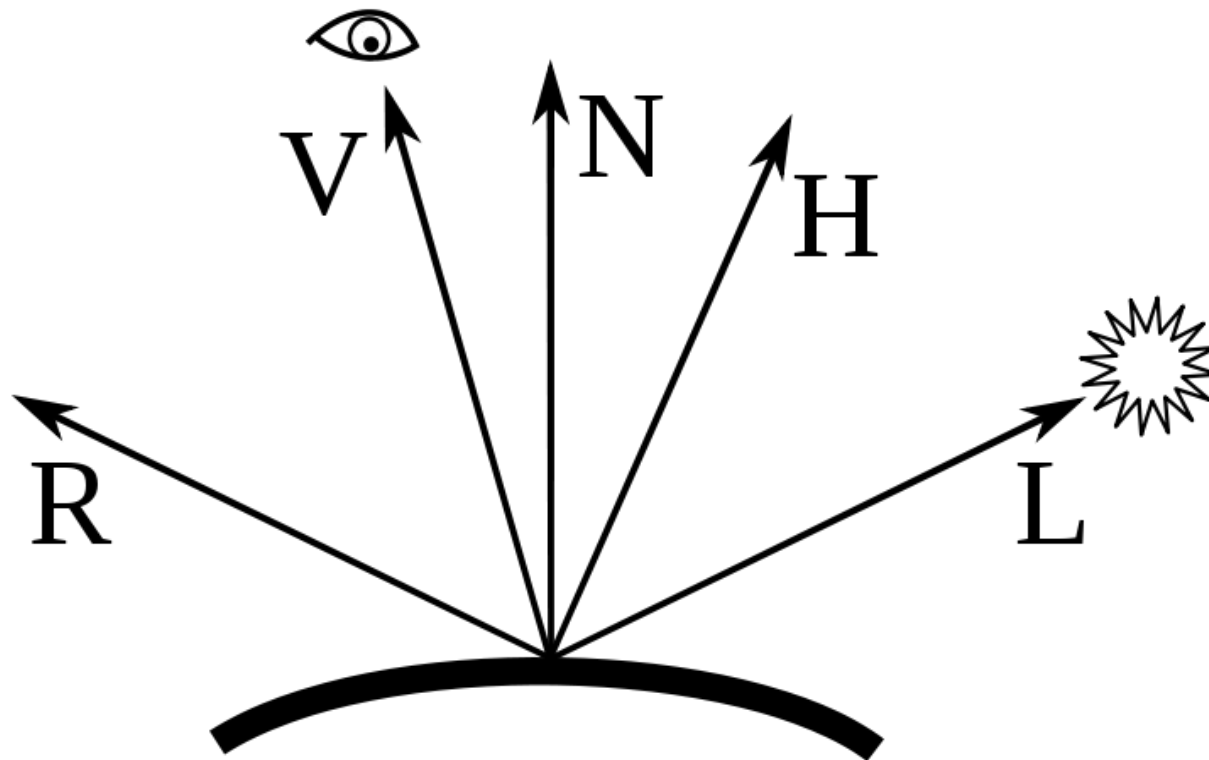
- Specular highlight of shiny surfaces
- Less expensive than ray tracing



# Phong reflection model

- Crytek's CryEngine
- Valve's Source Engine
- Epic's Unreal Engine 3.

# Blinn-Phong reflection model



[http://www.arcsynthesis.org/gltut/Illumination/Tut11 BlinnPhong Model.html](http://www.arcsynthesis.org/gltut/Illumination/Tut11_BlinnPhong_Model.html)

[https://en.wikipedia.org/wiki/File:Blinn\\_Vectors.svg](https://en.wikipedia.org/wiki/File:Blinn_Vectors.svg)

Questions?



- Bildverarbeitung, Klassifikation und Visualisierung, Teil 2, Heiko Neumann, Inst. f. Neuroinformatik, Fakultät für Ingenieurwissenschaften und Informatik, Universität Ulm, 2013/2014
- [https://en.wikipedia.org/wiki/Global\\_illumination](https://en.wikipedia.org/wiki/Global_illumination)
- [https://en.wikipedia.org/wiki/3D\\_rendering#Reflection\\_and\\_shading\\_models](https://en.wikipedia.org/wiki/3D_rendering#Reflection_and_shading_models)
- <http://www.pcper.com/reviews/Graphics-Cards/Ray-Tracing-and-Gaming-Quake-4-Ray-Traced-Project/Quake-4-Ray-traced>
- [https://en.wikipedia.org/wiki/Gouraud\\_shading](https://en.wikipedia.org/wiki/Gouraud_shading)
- [https://en.wikipedia.org/wiki/Phong\\_shading](https://en.wikipedia.org/wiki/Phong_shading)
- [https://en.wikipedia.org/wiki/Diffuse\\_reflection](https://en.wikipedia.org/wiki/Diffuse_reflection)
- [https://en.wikipedia.org/wiki/Lambertian\\_reflectance](https://en.wikipedia.org/wiki/Lambertian_reflectance)
- <http://www.arcsynthesis.org/gltut/Illumination/Tut11%20BlinnPhong%20Model.html>