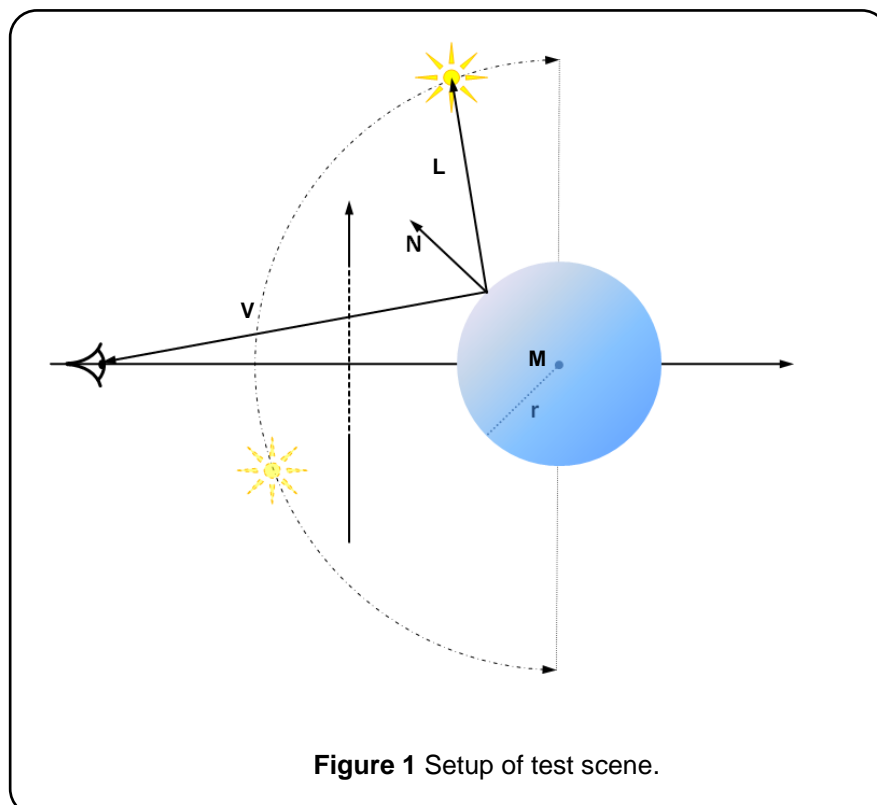Konstanz, 28.09.2024

Assignment 4

Computer graphics

Deadline 22.01.2025

Preliminary remark: Do not use for this assignment `OpenGL`, `GLUT`, `GLAUX`, or other library-functions! You can use the provided vector and matrix classes.

In this assignment, a simple ray-tracer based on Phong-illumination is implemented. Define first a simple scene with a sphere as in Figure 1. The sphere is centered on the z-axis. The light source is placed interactively (keyboard interaction) on a hemi-sphere around the sphere center. For the implementation of the ray-tracer ray are traced from the eye point through each pixel of the image plane into the scene and tested for intersections with the object in the scene. If the ray intersects an object, the pixel color is computed using Phong illumination. Otherwise, the background color is used.

Figure 1 Setup of test scene.

Fakultät für Informatik
Labor für Computergrafik
Prof. Dr. G. Umlauf

Hochschule Konstanz
University of Applied Sciences

Exercise 8 (Intersections)   5 points

Implement the function

```
CVec3d intersectSphere(CVec3d EyePos, CVec3d ViewDir)
```

to compute the intersection of a sphere with a view ray. In case there is no intersection, the function returns a point with negative third coordinate. Otherwise, the third coordinate is not negative.

Exercise 9 (Phong-illiumination)   5 points

Implement the function

```
Color illumination(CVec3d HitPos, CVec3d EyePos),
```

which computes the color of an intersection point using Phong-illumination.

Exercise 10 (Combination of 8 & 9)   2+1 points

The radius and the color of the sphere should be manipulated using a simple keyboard interaction. Use the keys `r`, `R`, `g`, `G,` `b`, and `B` to change the color. Use the keys `d`, `D`, to change the radius of the sphere.