**Atmospheric Scattering**

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Computer Graphics

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# Abstract

# Introduction

Our atmosphere is a mixture of several processes which result in various effects that are noticeable throughout the day, these effects can cause sun’s light reflection, refraction or absorption. One of the most important is the scattering effect. Scattering is the process by which small particles in the atmosphere diffuse a portion of the incident radiation emanated from the sun. The scattering of sunlight in the atmosphere causes diffuse sky radiation, which is the reason for the blue color of the sky and the yellow tone of the sun itself, or even the clouds’ white color.

This phenomenon has been simulated using computer graphics, mostly to achieve a certain realism in a virtual world. This problem ban be studied from two different angles: the view from the Earth’s surface, or the view from space. A project with this features already existed for the Unity 3D engine, with both angles mentioned before. On this work assignment a new version for Nau3D engine was developed based on the previous mentioned project, although only the latter angle was focused on. The objective is to mimic atmospheric effects that a person would be able to see if they were in space, looking at Earth. The scene created is constituted by only two concentric spheres, one simulates the Earth and the other slightly bigger the atmosphere.

# Atmospheric Scattering

As mentioned before scattering is the redirection of electromagnetic energy by the suspended particles in the atmosphere. Depending on the size of the particle which the light reached the type of scattering will be different: if the size is smaller than the wavelength of visible light, the effect is Rayleigh scattering, if it’s about the same size, the effect is applied is Mie scattering. Rayleigh scattering influences the color of the sky, from the usual blue to the sunset red/yellow shades, due to the very small size of the average atmosphere particle (smaller that the wavelength reaching it). Mie scattering is responsible for the white/grey clouds’ colors which contain water droplets with a similar size as the wavelength reaching it.

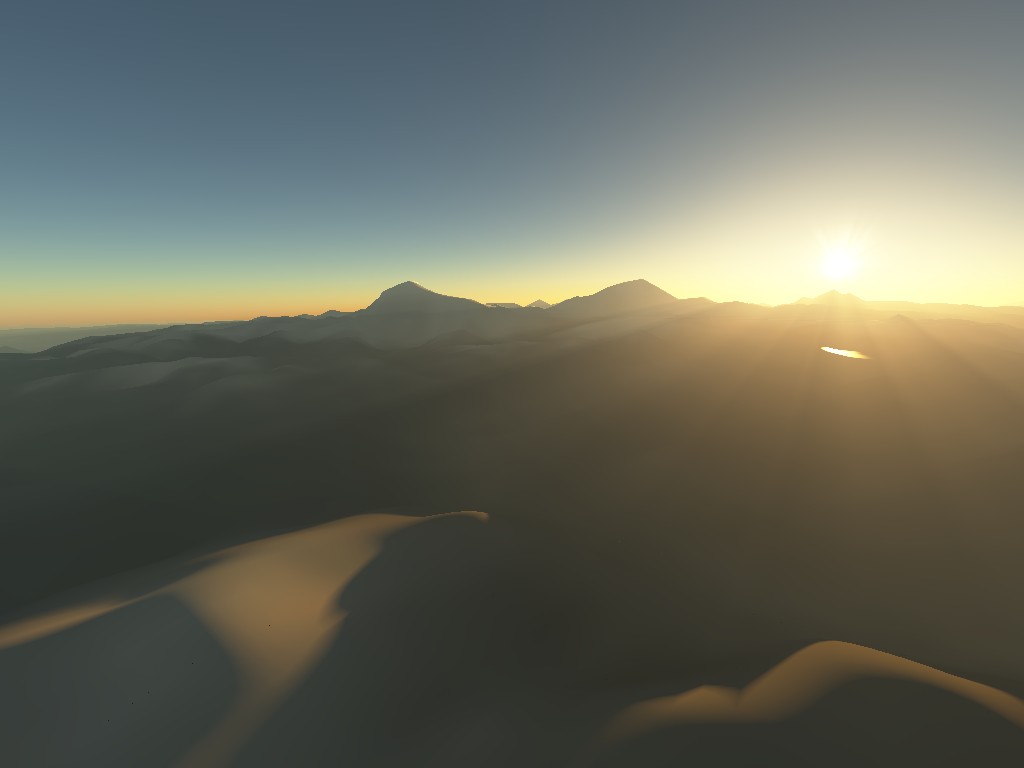


Figure 1 - Atmospheric scattering effect

## Rayleigh Scattering

Resumir isto: https://en.wikipedia.org/wiki/Rayleigh\_scattering

## Mie Scattering

<https://en.wikipedia.org/wiki/Mie_scattering>

# Result Comparison

Mostrar imagens do unity e da NAU3D

Podemos também mostrar as do “dentro” da atmosfera”

# Conclusion

Baseado nos shaders de um projeto do Unity

“sucesso” no shader da atmosfera

Referir erros nos shaders da terra

Possivelmente devido à má escala, valores de constants não aplicáveis à escala…

# References

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| [1] | "Atmospheric Radiation," Weather Edge, [Online]. Available: http://www.severewx.com/Radiation/scattering.html. |