

Project Abstract

Project Title

INTERACTIVE BLACK HOLE VISUALIZATION

Group Members

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Motivation

Gathering the attention of people and making them passionate about space. In particular, attracting students that could be the researchers of the future on this kind of topics.

Project Concept

A black hole is a huge concentration of matter packed into a very tiny space, called **singularity**. It is so dense that gravity just beneath its surface, the **event horizon**, is so strong that nothing, not even light, can escape it.

Moreover, super massive objects, like black holes, create very strong gravitational fields that are able to curve and stretch space-time, the “fabric” of the universe. This warping effect is at the basis some interesting phenomena such as gravitational lensing, spaghettification, and doppler effect.

Since light can't escape, black holes themselves neither emit nor reflect it. Therefore, everything happening into a black hole cannot be observed from outside.

However, some of them are surrounded by hot, swirling matter in what is called an **accretion disk**. The friction from this movement generate light ranging from radio waves to visible light and X-rays.

We would like to build a **VR artistic installation** consisting of an **Interactive Black Hole Visualization** that could be suitable for science museums and exhibitions.

The installation will showcase the physics of black holes in an interactive way, employing both visual and auditory feedback into an immersive multimedia scenario.

The user experience happens either through the interaction with the virtual world or by changing some parameters which control the physical model. For instance, the user could control an astronaut or a spaceship inside the scene.

The auditory component consists of a 3D audio rendering connected with the events happening into the virtual scene.

For the auditory part, we wish to create a captivating (though not realistic – as sound cannot propagate in empty space) soundscape, comprising of both background generative music and 3D audio rendering, depending on the events happening in the scene and the user interaction.

The virtual world will be rendered inside **Unreal Engine**, through the creation of custom shaders which implement the physical laws. This engine allows us to easily introduce additional elements such as asteroids and other astronomical objects. Moreover, it provides some built-in functionalities for 3D audio rendering.

The background music will be dynamically created through a generative algorithm in **SuperCollider**, which is controlled by Unreal Engine via the OSC communication protocol.