

APPLICATIONS FOR VIRTUAL REALITY

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Abstract – This article presents two projects:

- **ChemistryVR** – an attempt at recreating atoms and molecules. The project is split into three major components: The Atomic simulator (the user can generate any atom in the periodic table and view it), the Molecular generator (the user can view a number of pre-assembled molecules), the Particle Collider (the user can “simulate” particle collisions, similar to the Large Hadron Collider in Geneva)
- **SpaceSimVR** – a space combat simulator, where the user is in control of a starship with modifiable components. So far, the player can only fight through a pre-set number of enemies, but the project will be expanded in the future to incorporate other aspects such as mining, trading and building of stations

Index Terms: Unity3D, Virtual Reality, Oculus Rift DK2, Chemistry, Space, Simulator

I. INTRODUCTION INTO VR

Virtual Reality or virtual realities (VR), also known as immersive multimedia or computer-simulated reality, is a computer technology that replicates an environment, real or imagined, and simulates a user's physical presence and environment to allow for user interaction.

A person using virtual reality equipment is typically able to "look around" the artificial world, move about in it and interact with features or items that are depicted on a screen or in goggles. Most 2016-era virtual realities are displayed either on a computer monitor, a projector screen, or with a virtual reality headset (also called head-mounted display or HMD). HMDs typically take the form of head-mounted goggles with a screen in front of the eyes. Programs may include audio and sounds through speakers or headphones.

II. CHEMISTRYVR

- The Atomic viewer is what we call the scene in which we can generate atoms. Rutherford's planetary model was chosen, as it is the first thing that comes to mind when we think of an atom. Even if it doesn't accurately reflect the dual nature of the electron (particle and wave), it's easy for anyone to understand, without any special knowledge in Chemistry or Physics.

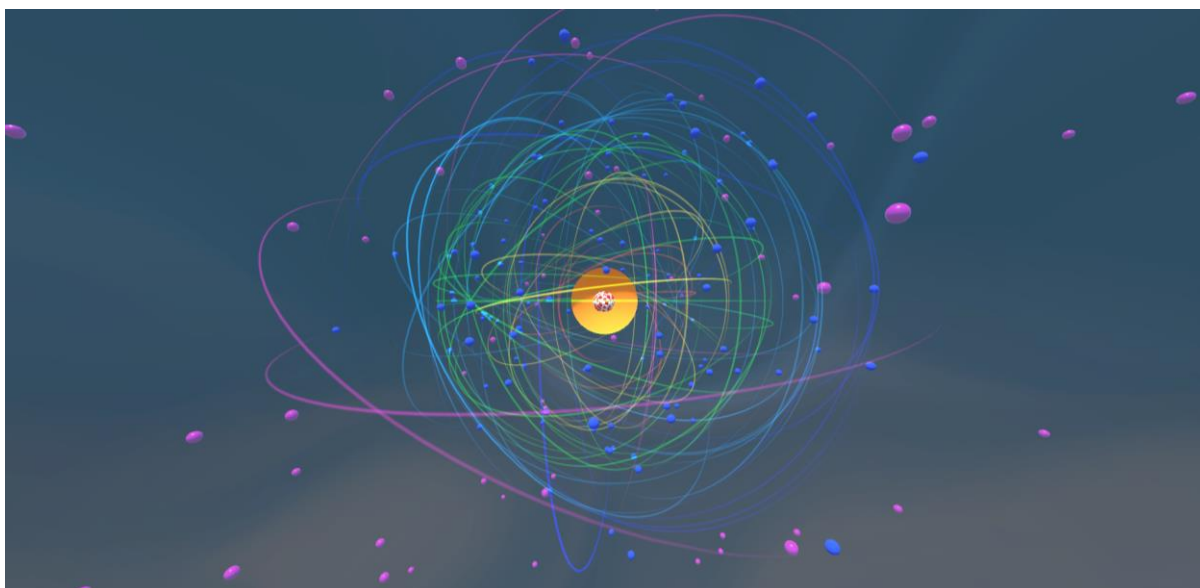


Figure 1 – Here we can see an Oganesson (formerly known as Ununoctium), which is the heaviest known element in the Periodic Table (atomic number 118).

- The Molecular viewer is the scene where we can view various molecules that are pre-assembled. The user selects a molecule, and a field of that molecule is generated. Both the Atomic and Molecular viewers have a panel in which the user can see various information about the selected element.

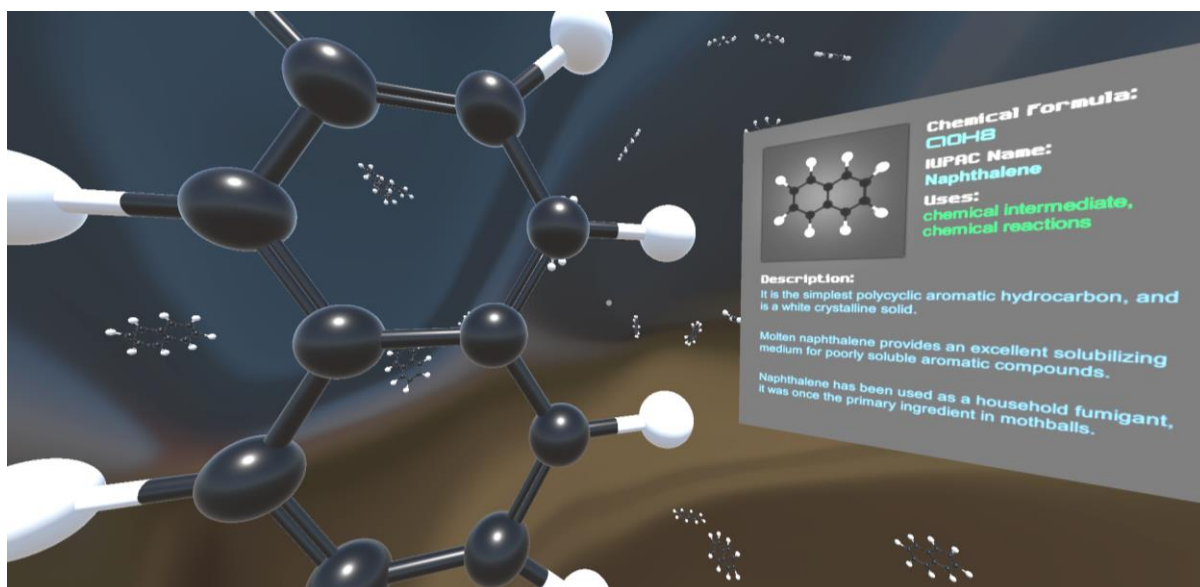


Figure 2 – Here we can see a Naphthalene molecule, along with the information panel about it.

- A particle accelerator is a device that uses electromagnetic fields to propel charged particles to high speeds and to contain them in well-defined beams. Large accelerators are best known for their use in particle physics as colliders (e.g. the LHC at CERN). Other kinds of particle accelerators are used in a large variety of applications, including particle therapy for oncological purposes, and as

synchrotron light sources for the study of condensed matter physics. There are currently more than 30,000 accelerators in operation around the world. In our simulated version of the particle collider, we send protons on a collision course, which in turn will generate subatomic particles. The process of generating the path of the subatomic particles is far from accurate, but it mimics the real thing just enough to get a good enough representation of what's happening when particles collide at near light-speed.

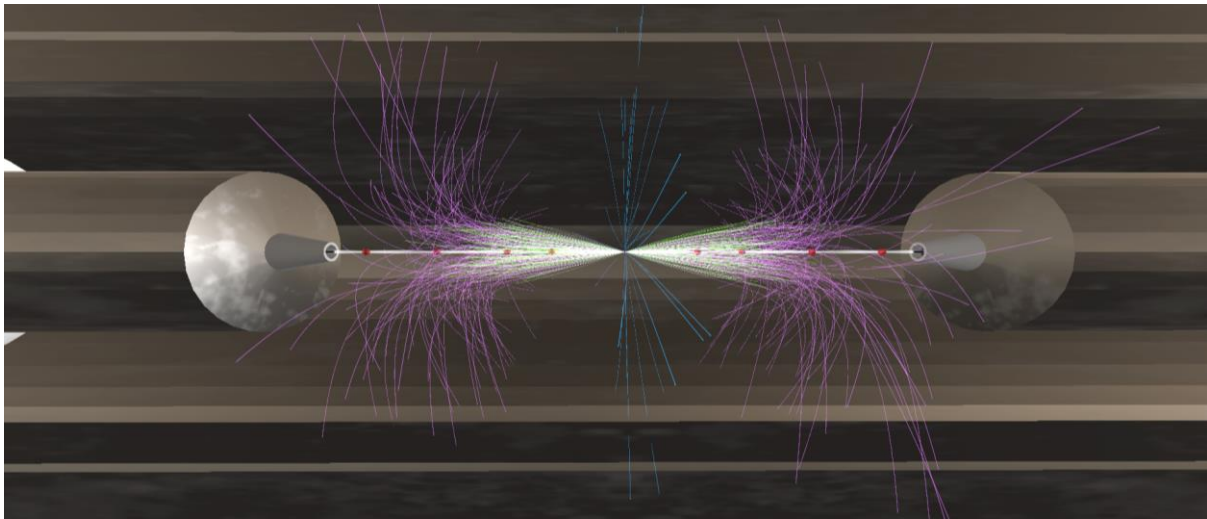


Figure 3 – The inside of the particle collider moments after a few collisions. Each color represents a different particle. (Light Blue – Boson, Purple – Quark, Green – Lepton, Red – Proton).

Software used in the project: Unity3D (C#), Blender, Visual Studio 2015

You can check a video overview, along with a download link (in the video description) here: https://www.youtube.com/watch?v=YKiphwkIZ_Y

The game should run fine on even Low End hardware, and owning a VR Headset is not required to play it.

III. SPACESIMVR

- In the Hangar, the player is able to equip the ship with an array of weapons. There is a panel that displays the information on the selected weapon, ship and some special metrics (such as the energy drain per second if all weapons are firing). In the future more ships, weapons and equipment will be added in order to offer a more customizable gameplay experience.



Figure 4 – In the image we can see the player's ship, along with the hardpoints for the weapons that it has. In the panel to the right we can see it displays information about the selected weapon.

- After the player launches into space, he is inside the cockpit of his ship, in the middle of a combat zone. Fortunately, he is not alone. His allies will aid him in the fight. The AI controlled ships know to determine their best opponent to maximize their efficiency in combat, for example: a cruiser would be more effective against a gunboat rather than a fast-moving fighter or a fighter would be more effective against a bomber. The AI controlled turrets pick targets that they can only track. They also calculate the intercept point so the projectile will theoretically hit the target as long as the target keeps its speed and heading.



Figure 5 – Here we can see the player firing at a group of enemy ships. The ship cockpit features a spherical mini-map with the objects in the proximity, panels that represent various ship systems and the crosshair that displays useful information about a target.

Software used in the project: Unity3D (C#), Blender, Substance Painter, Visual Studio 2017

You can check a video overview, along with a download link (in the video description) here:
https://www.youtube.com/watch?v=YKiphwkIZ_Y

The game is pretty optimized, being originally designed for Android, but it's pretty CPU intensive. Owning a VR Headset is not required to play the game.

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