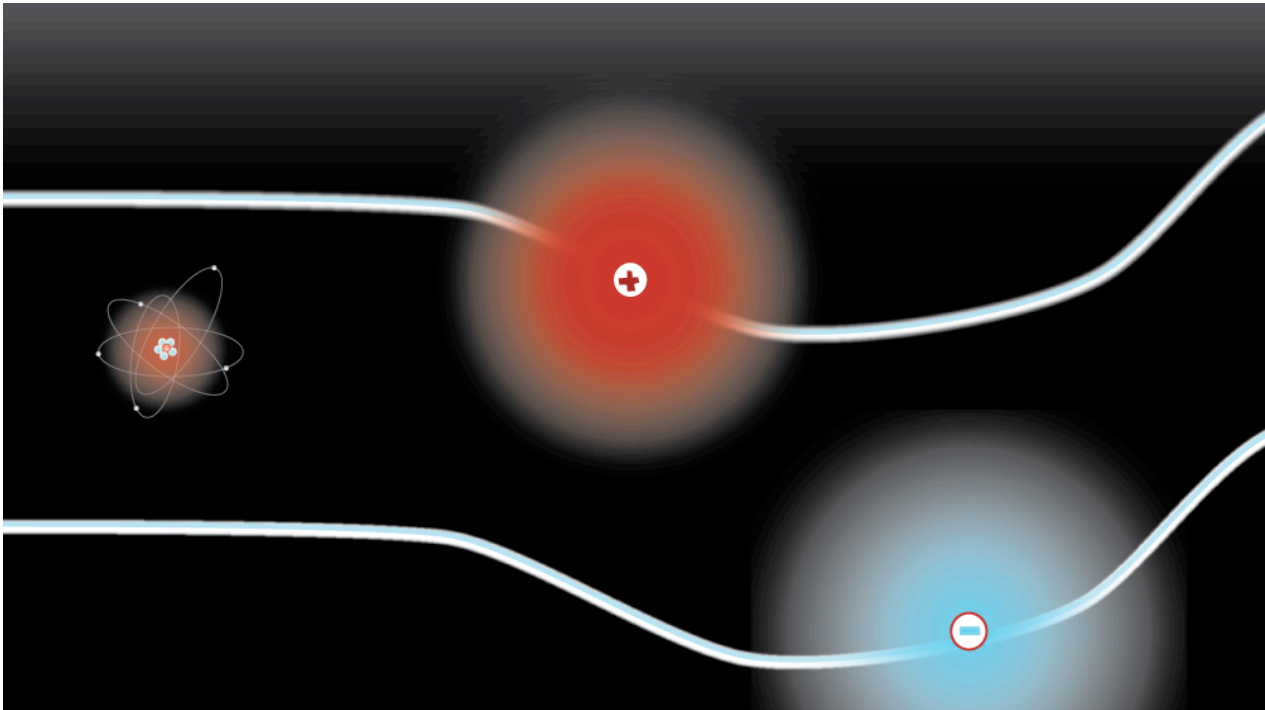# Game Proposal

Game Description

The goal of this game is to move an atom through an nearly infinite level as fast as possible. To increase the difficulty, an end-time scenario is modelled: If the player is moving to slow and can not overcome the obstacles in time he's getting killed by the supernova.

Game Mechanics

The player is playing a small physical atom. With each atom having a certain number of
- Electrons
- Protons

The number of **electrons** and **protons** of the atom defines its **charge**. If it has the same number of electrons and protons it has no charge. Depending on its charge, the player's atom is either attracted to an obstacle or repelled. He can then choose to do two things:
- Eject electrons to have a positive charge and become a simpler chemical element
- Eject protons to have a negative charge and reduce its weight

The simplest atom is the Hydrogen element with one electron and one proton which can not eject any further protons or electrons.
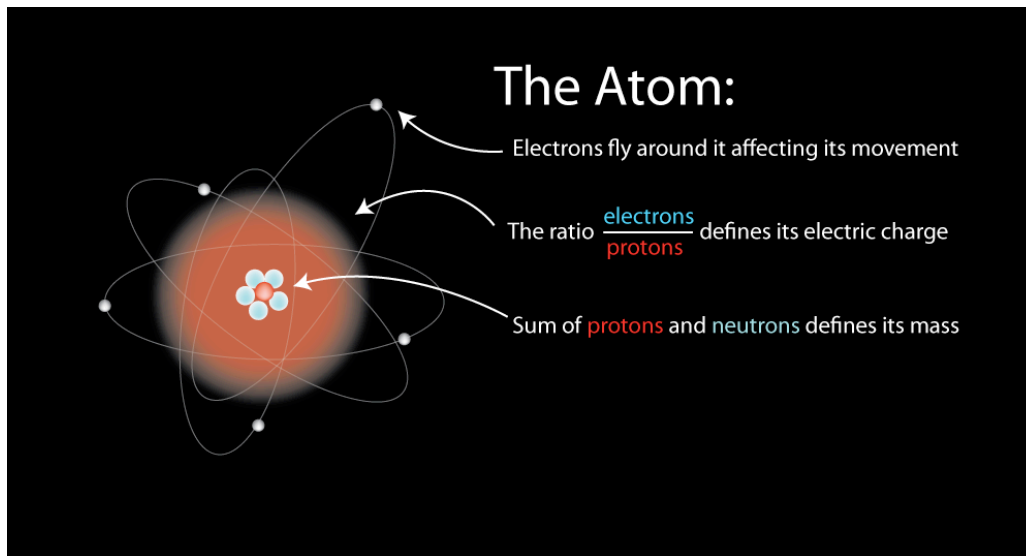
Movement Principles

Attraction and repulsion is governed by the following formula (electromagnetive charge) :

$$a_i(t) = \sum_{\text{charges} Q} \frac{Qq}{4\pi\epsilon_0 |r|^2} \bar{r}$$

Where Q= charge of the element, q=charge of the player r= distance and r=direction
We then compute the next step using a timestepping scheme.
Depending on the number of protons, the player is able to move around. The more protons he has, the higher his acceleration and he's able to move around lowly charged obstacles without changing his charge.
Depending on the number of protons, the atom has a certain size. Which might force the player to shed protons to reduce his size to fit through an obstacle.
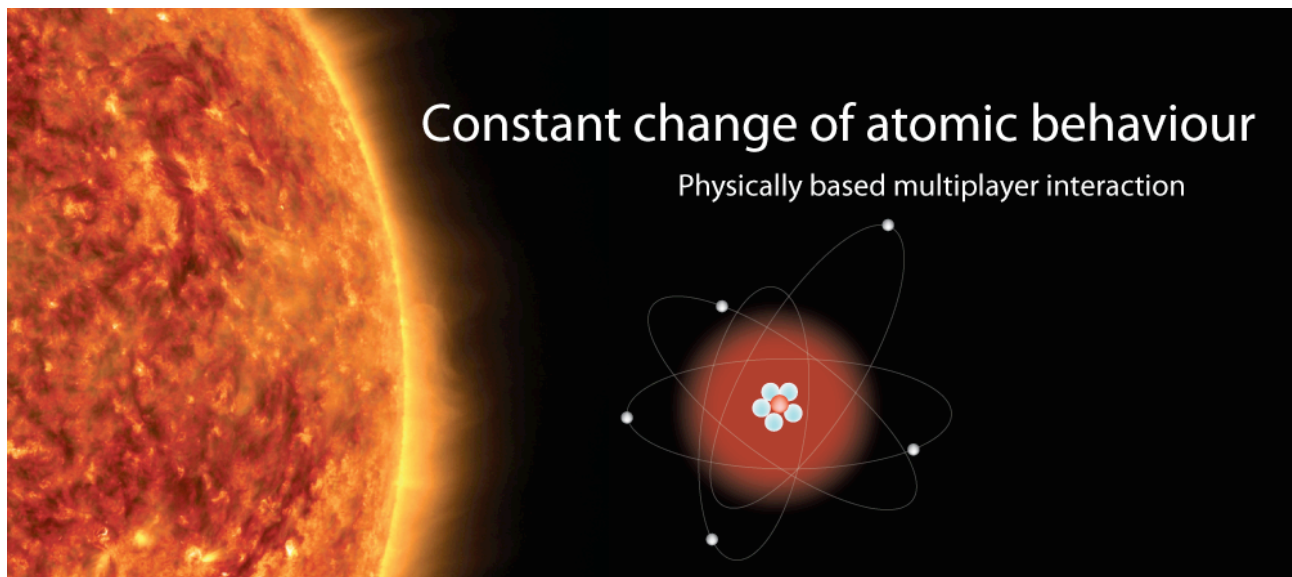
Obstacles

In the following we will describe some of the obstacles a level could incorporate.
- A simple attraction or repulsion point.
- A particle splitter that splits away half of the protons.
- Particle accelerator which increases velocity which accelerates the player further an collides him with another atom
    - He merges with the atom, if the waiting atom has less weight
    - Or he loses some part of himself to the particle.
- Supernova: Destroys the level behind the player. If the player isn't fast enough, the player is consumed as well.
- Quarks: Flying around stealing electrons
- Higgs Bosom: Destroys protons from the player (ideally one, an exponential distribution would be nice too)

There are many more obstacles we can think of. We will add those if we have time.

Big Ideas

Layered Requirements

- **Functional minimum**
  - Fully functional controls and game mechanics
  - Atoms moving around
  - No obstacles
- **Low target**
  - Primitive graphics
  - Primitive obstacles
    - Simple attraction and repulsion
  - Highscore
- **Desireable target**
  - Cool graphics
  - Nice levels
  - Multiplayer modes
- **high target**
  - Special effects
  - Special obstacles
  - Different colors for the different
  - Automatic Level generation
- **extra**
  - Ingame help structure (like tutorial levels, etc)
  - extra graphics
  - story
  - The concept of heat
  - Molecules

Development schedule

Week	Task	Assigned To
1	Inital Project Setup	All
	Simple Atom Graphics	Nicholas
	Atom Movement	Christian
	Simple First Level	Pascal
2	More advanced atom movement icluding disturbing electrons	Christian
	Game logic for electronic charge	Pascal
	Simple Obstacles	Nicholas
	Glowing Graphics	Nicholas
3	Highscore	Christian
	Advanced Obstacles	Nicholas
	Multiple Players	Pascal
4	Better Graphics including nice shadows	Nicholas
	Change of player properties	Christian
	Automatic Level Generation	Pascal

Assessment

Our system simulates a small virtual atomic world. Each player is playing an atom. His goal is to grow and get through the level as fast as possible.
The main strength of our game should be our revolutionary game mechanic. We consider all types of gamers for game playing and there is no specific age required for our game.