ASTROSTEM: The evolution of stars

The legend of the scenario will be as follows:

Text style	*Function*
Plain Text	Dialogue that appears to the player
Bold text	Character name
Underlining text	Phase description
Grey coloured text	World details
Green coloured text	Subtitle text

The player spawns in front of an observatory, modelled roughly with the Las Campanas and the Paranal observatory in mind, in a desert setting. While they follow the path from the spawn point to the entrance of the observatory, instructions will appear as subtitles.

- Use WASD to move
- Double tap and hold W to sprint
- [SPACE] to jump
- [Right Click] to Interact
- Visit the observatory

Astronomer:

- Hello! You must be the student we have to give a tour! Welcome to our Observatory!
- This is a top-notch observatory. See how it is built in a desert? That's because the sky looks clearer when the humidity is low, also when there aren't many light sources distracting your view. Making the desert the perfect place to build an observatory.
- Inside we are going to face a series of challenges in order to simulate the different stages of a star's life.
- Here, take this book & quill, this camera and this portfolio. They will help you keep track of what you've learned.
- What are you waiting for? Let's get inside!

The NPC gets teleported inside. The front door is unlocked.

The first room is a flat surface with water running to the middle.

Astronomer:

- In the great vastness of space, there is matter running around freely. When enough is gathered in a certain region, it starts to pull more matter towards it.
- That happens because of gravity! When enough matter is gathered, a star is born! Literally!
- Inside the stars we can find mostly hydrogen and helium. Most stars have small amounts of heavier elements like carbon, nitrogen, oxygen and iron, which were created by stars that existed before them.
- Here in this pool of water, we can simulate the behaviour of a star being born.
- Click the button to add more mass. And see how more mass is gathered to the centre.

When the player has added a few atoms

Astronomer

- Good job! It seems like a somewhat strong gravitational field is formed.
- Keep placing matter inside of the star. Take note that now the mass will accumulate faster inside the star!

When the player has added enough atoms, the place lights up, a block rises – representing a star.

Astronomer:

- And just like that. A star is born! It's really beautiful, isn't it?
- Let's go to the next room and continue its journey.

The next room has displays on the wall on what would happen inside the nucleus of a star if only gravity existed and another one explaining what would happen if only nuclear reactions took place. Then a third display shows the balance between those two.

Astronomer:

- Let's see what happens inside the star right now, shall we?
- We already know that gravity attracts atoms inside. Just like in the first display.
- But that doesn't explain the light that is emitted from the stars. Let's see the next display.

The astronomer is teleported to the next display

Astronomer

- This display shows what happens if we have only nuclear reactions taking place. But if only nuclear reactions took place, then all the matter would escape the star and the star would cease to exist.
- The answer is in the mean ground. Let's look at the third display, where we can observe both gravitational pull as well as nuclear reactions.

The astronomer is teleported to the last display

Astronomer

- Ah, yes. Perfect balance. That way, little by little, material is being used up and light is emitted. What could happen next? Could the star burn out all its mass? Could it gather so much mass faster than the rate that it can burn it? Is it going to remain on a state of perfect balance for ever?
- Let's go to the next room and find out.

This is room has three telescopes, each pointing at a white dwarf, a neutron star, and a black hole respectively.

Astronomer:

- So, this is the room with the telescopes. We have used special telescopes that count the radiation emitted from a star to determine in what stage they are. We have found three different stars, at the end of their cycle, and we have now pointed some optical telescopes so that we can see what they look like.
- Come back to me when you are done!

<u>When the player uses the first telescope</u>

Astronomer

- This is a white dwarf. This had mass about the same as the mass of the sun that is in the centre of our solar system.
- Most of its material is burned out. And there isn't enough mass to create a strong enough gravitational field to gather more. There are no longer nuclear reactions that take place in the nucleus. Little by little, the star will run out of energy and will no longer glow. Making it a black dwarf.

The player sees the white dwarf and after a few seconds they are back at the observatory.

When the player uses the second telescope

Astronomer

- This is a neutron star. This had about 5-10 times more mass than our sun. After an intense explosion, this is the final stage. Only neutrons are inside the nucleus now, everything else has been either used in a reaction or has left with the explosion.

The player sees the neutron star and after a few seconds they are back at the observatory.

When the player uses the third telescope

Astronomer

- This is a black hole. This had mass over 20 times the mass of our sun. The nuclear reactions weren't enough to push out or burn out enough mass, so now the star has collapsed in itself.
- They have a great gravitational pull, where they even draw in light as well! So, it is impossible to trach them with the optical telescope. See for yourself!

The player sees the black whole and after a few seconds they are back at the observatory

When the player interacts again with the astronomer:

Astronomer

- Are you done?

If the player selects: YES

Astronomer

- That's wonderful. I am afraid we are done for today. Sorry I couldn't show you more about the different stages of a star. After all, this is just a demo version. You can still look around and use the telescopes as much as you want!

If the player selects: NO

Astronomer

- OK. I will be here when you're done.

If the player tries to interact with the NPC after they have already clicked yes:

Astronomer

- I am afraid we are done for today. Sorry I couldn't show you more about the different stages of a star. After all, this is just a demo version. You can still look around and use the telescopes as much as you want!