Effect 1: Black Hole

The first effect is a black hole that slowly expands, then rapidly pulsates. Purple particles are then sucked into the black hole. After a set duration, the black hole dissipates, creating a large sparkle explosion that fades out quickly afterwards. This is a OneShot effect that can be spawned by pressing 1 in the scene.

The controllable variables are:

- The explosion size
- The explosion duration
- The curve at which the explosion dissipates
- The tint of the black hole and the particles

Effect 2: Shooting Stars & Ambient Stars

The second effect is a combination of shooting stars and ambient stars that float in the sky. The shooting star eventually fades, creating a sparkle that rotates slowly. The shooting stars are able to be toggled by pressing 2 in the scene.

The controllable variables are:

- The number of shooting stars
- The lifetime of the shooting stars and ambient stars
- The sparkle rotation rate
- The trajectory of the shooting star

Effect 3: Portal

The third effect is a portal that shows an entirely different environment inside it. The edges of the portal dynamically spiral, with refraction and glowing lines going towards the centre of the portal to indicate movement. The portal can be toggled by pressing 3 in the scene.

The controllable variables are:

- The portal size
- The portal hue shift
- The portal colour
- The force magnitude at which the portal edges spiral

Resources Used: Inspiration

For each particle effect, I had a variety of inspirations. I took a look at each inspiration source and tried to draw out what made them successful, and hoped to use that in my own creation.

For the black hole:

- Horizon's Black Hole from Apex Legends. It has a slight refraction that creates the illusion of gravity around it. It also blends seamlessly with the world, absorbing all light that passes through it.
- Venti's Wind's Grand Ode from Genshin Impact. While not a black hole, it has elements of a black hole that made me consider it nevertheless. For instance, the pulsation of the projectile itself creates dynamic movement, which will prevent my black hole from looking stagnant.
- Prismatic Warlock's Freezing Singularity from Destiny 2. This rendition of a black hole is closest to what I envisioned for my own black hole. The colours are a deep purple, and there is a rotation and pulsation that creates a dynamic feel to the grenade.

For the stars:

- Ness' PK Starstorm from Super Smash Bros Ultimate. While this is a tad too big for a shooting star, the trails and colours give the whole effect a very grand and majestic feel, which I think is appropriate for a shooting star.
- The meteor shower scene from Your Name. This is the closest to what I envision for a shooting star; multicoloured trails and bright colours contrasting against a dark sky. The ambient stars are also much smaller in contrast to the shooting stars, making the shooting stars a more focal element.

For the portal:

- Painting Portals from Super Mario 64. What I enjoy most about these is the ripple effect that the player creates when jumping through them. I want to create a similar effect where the portal changes based on the player's proximity to the portal.
- Pulsefire Caitlyn's Recall from League of Legends. The portal shows a scenery with flowing energy surrounding the portal edges. I would like to mimic this and show a scene where the player can "travel" into.
- Doctor Strange's Portal from the Marvel Universe. The sparky edges of the portal are effective at "containing" the portal, but there are too many sparks, making it look like a magic trick rather than something from a sci-fi universe. With different colours and different amounts of sparks, I believe I could make a portal that fits into a sci-fi universe.

Resources Used: Tutorials

I adapted materials from a few tutorials, namely:

- Noise Distortion Tutorial from CodeLikeMe. I used part of their material in the refraction master material.
- Doctor Strange Portal Tutorial from ABritishGameDev. I used their material as a building base for my depth master material.
- Vignette Tutorial from James Bland. I used their vignette pseudocode calculations as a base for my vignette material function.

What I'm most proud of

I'm most proud of my shooting stars and how they turned out. Not only are they pretty to look at aesthetically, but I believe the user parameters I assigned to them make them flexible enough to emulate even falling stars and how frequently they show up. There are also some things I can point out that I'm proud of in the other effects, such as the fact that my black hole's refraction looks quite seamless, and how my portal's clearness fades depending on the player's distance from it.

What I would improve

I would try to think about optimization earlier in the process if I were to retry this. There were countless points in the creative process where I cut corners, and thus created more and more inefficiencies in my particle systems. This is mostly noticeable in my portal particle system, where upon checking my shader complexity, it was extremely bad. Therefore, next time, I will try to think about optimizing my shaders before including them in my particle systems.