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# Analyzing Interstellar Film And How Scientifically Accurate It Is

In Christopher Nolan's 2014 film *Interstellar*, humanity is forced to expand throughout the galaxy in order to continue the human race in the face of a cataclysmal famine that threatens the vitality of the Earth. While exploring and encountering three potential colonial worlds that are connected to the Milky Way galaxy through an extra-terrestrially imposed wormhole, the crew of the *Endurance* is forced into several life-or-death situations due to the harsh physical conditions of these planets and travel through space in general. Remarkably, the physics concepts portrayed in this movie are accurate to a large degree, as is credited to the project oversight performed by theoretical physicist Kip Thorne. In this regard, physics ideas such as Einstein's Theory of General Relativity, the constancy of the force of gravity as considered through the application of Newton's Law of Universal Gravitation, and the real-life application of Murphy's Law all hold true at various points in the movie.

Einstein's Theory of General Relativity, as an ingenious synthesis of the myriad of ideals concerning gravity at the dawn of the nineteenth century, represents a generalization of the principles of special relativity and Newton's Law of Universal Gravitation whereby gravity is a geometric property of space and time. As these two dimensional applications come together in the three dimensional world that is the physical world, it can be seen that the interdependent nature of space, time, their synthesis spacetime, and gravity can have interesting effects on the natural world. For example, a phenomena called gravitational time dilation can occur whereby the amount of time passed at different locations of gravitational force can differ relative to each other. This phenomena can be seen in the movie wherein Cooper and Amelia Brand visit the planet known as Miller, spending a little over an hour attempting to recover the probe's data and then escape the planet's devastating tidal waves; however, upon returning to the *Endurance*, the gravitational time dilation had caused what seemed to be sixty minutes to stretch into twenty-three years on Earth due to the gravitational differences. Furthermore, the mere presence of the black hole Gargantua at the center of the galaxy housing the colonization attempts also supports Einstein's 1905 findings: Einstein proposed that as space and time broke down and were distorted due to intense astrophysical phenomena, such as the ending of a massive star body, a distortion could appear that could trap even light, thus creating a black hole. The very presence of Gargantua at the center of the galaxy, despite the science-fiction instilled into it following Cooper's falling into it, supports Einstein's theories.

Whenever the crew of the *Endurance* was to land on a planet in order to observe its potential for colonization, a crew member was all but guaranteed to comment on the enhanced or reduced effects of gravity on the said planet. This changing factor of gravity can best be understood through the application of Newton's Law of Universal Gravitation, which states that the magnitude of the force of gravity upon an object is dependent on the mass of the objects in question (the object exerting the gravitational pull and the object being pulled) and the distance between the two. In this regard, it makes sense that whenever the *Endurance* were to land on a planet that has a smaller mass than Earth, the effects of gravity would be felt more strongly by the crew; contrastingly, the opposite would also be true, with larger planets enacting a larger gravitational pull. Because of this, the ever-present gravitational force, as it is effectively modified through an application of Newton's Law of Universal Gravitation, allows for many

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aspects of this movie to support real-world attributes of gravitational pull.

Everybody has heard of Murphy's Law: if something can go wrong, it most definitely will. While not technically a testable and definite physical concept, this natural law certainly can be observed in both real life and in the context of the movie *Interstellar*. As the now reduced crew of the *Endurance* approach the planet known as Mann, the intense foreshadowing of the film becomes apparent: something is about to happen. Meeting the astronaut (also named Mann) sent ahead to discover the viability of this planet as a colony, it is quickly apparent that this planet is uninhabitable. Mann, in his madness induced through years of isolation on this icy planetoid, has decided that the recolonization through the embryonic storages aboard the *Endurance* must occur, and he soon leaves Cooper to die, kills Romilly, and takes off to board the ship. Upon his attempts to dock, he blows the air lock into pieces, leaving the crew left for dead watching their destroyed spaceship ricochet off the momentum of the explosion. Things most certainly went wrongly very quickly, affirming the concept of Murphy's Law.

As can be seen through the above examples, *Interstellar* certainly pays a remarkable degree of attention to ensuring scientific accuracies in its plot. It is this attention to scientific detail that sets this movie apart from other holiday flicks of 2014; Christopher Nolan and Kip Thorne certainly worked extremely cohesively in producing a scientifically unique achievement in cinema.

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