Gravitational Impact of the Death Star on Endor and Earth-like planets

Simon Tebeck, Pranav Gupta
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1 Problem

That's no moon. It's a space station. This iconic line from the 4th. episode of the Star Wars Saga introduced the Death Star to the protagonists, an enormous armed space station with a super laser capable of destroying whole planets. But when it can be confused with a moon, how massive is it and how strong is its gravitational impact on other objects? More specifically, if the Death Star is orbiting Endor or let's say Earth, does it have a measurable impact on the planet and the life on it? Does it create dangerous tides or change the gravitational force locally? And what does the sudden destruction of the space station imply physically?
An analysis of these questions mostly focuses on the study of Newton's Law of Gravity

$$F_G = G\frac{M_1 M_2}{r^2} \tag{1}$$

and further explores the three-body problem. However, more objects can be included to increase the challenge of the simulation, for example, the Earth's moon or other battle stations (e.g. Star Killer Base). In addition to that, many of the basic equations of motion will be used, including the ones of circular motion:

$$F = ma \tag{2}$$

All this will help find the answers to the question: What gravitational impacts does the Death Star have?

2 Approach

To succeed in this project, firstly a couple of input parameters must be obtained: Quantities like masses, volumes, or distances are needed, and while some of them are specified in fictional literature (see here), others are drawn from fan analyzes (see here) or will be estimated based on film footage (see here). The most important algorithm is the integration algorithm, and because of the conservation of energy, Velocity Verlet will be used mainly.
To check if the Death Star has significant impacts on orbits and rotations, several quantities will be observed and validated: First of all, an analysis of the angular velocity ω with and without the Death Star is carried out, similar to previous problems. Another simple indicator, especially when considering the planet's rotation, is the center of mass: How much does it change, and how does that compare to a system only with a moon? Finally, is the impact of the Death Star (at least when using heavier estimations of its mass) so big that the trajectory changes visibly?
To observe gravitational changes on the surface of planets, forces of many probe masses all around a sphere will be calculated, which also gives information about possible tide changes. This will be held against a control scenario consisting of Earth and Moon to estimate the scale of the tides.
The destruction of the Death Star will be looked upon in two scenarios: Firstly, what happens

when the space station suddenly fully explodes and its mass is not around the planet anymore? Does the orbit of the planet change because of that? Secondly, what happens if a significant part of the debris falls on the surface, how much energy will be released, and will that affect life on the planet?
For all objectives, we aim to achieve appealing visualizations using Matplotlib.

3 Objectives

1. Obtain or produce estimations of significant quantities (masses, volumes, distances).
2. Simulate the orbits of Endor and Earth (with the moon) with and without the Death Star: We will look at quantities like the angular velocity ω or simply the center of mass to quantify the space station's impact. Plot the trajectories of the planets to see whether they even change visibly.
3. Calculate the impact on the planet's surface (changes of the gravitational force and tides): Simulate the gravitational forces on numerous probe masses around the globe and visualize the strength of the local forces with vectors or colors. Create a control scenario with the Earth and Moon to see how certain changes of g correspond to our tides. Then simulate Endor and the Death Star as well as Earth, Moon, and the Death Star and compare the changes of the gravitational forces. Estimate tides in comparison to the control scenario.
4. Find out what the sudden disappearance of the Death Star implies - does it destabilize the orbit of a planet? What happens if the mass falls on that planet?: Define and measure parameters indicative of orbital destabilization such as changes in the rotation and angular velocity. Does the trajectory around the Sun change?
5. (Optional) Incorporate additional celestial bodies, such as the Star Killer Base, to enhance the complexity of the simulation.
6. (Optional) Develop an interactive web application allowing users to modify parameters and visualize their scenarios.