

1 Find Force Law: Spiral Orbit

In science fiction movies, characters often talk about a spaceship “spiralling in” right before it hits the planet. But all orbits in a $1/r^2$ force are conic sections, not spirals. This spiralling in happens because the spaceship hits atmosphere and the drag from the atmosphere changes the shape of the orbit. But, in an alternate universe, we might have other force laws.

Find the force law for a central-force field that allows a particle to move in a spiral orbit given by $r = k\phi^2$, where k is a constant.