The Path and Effects of an Asteroid Hitting Earth

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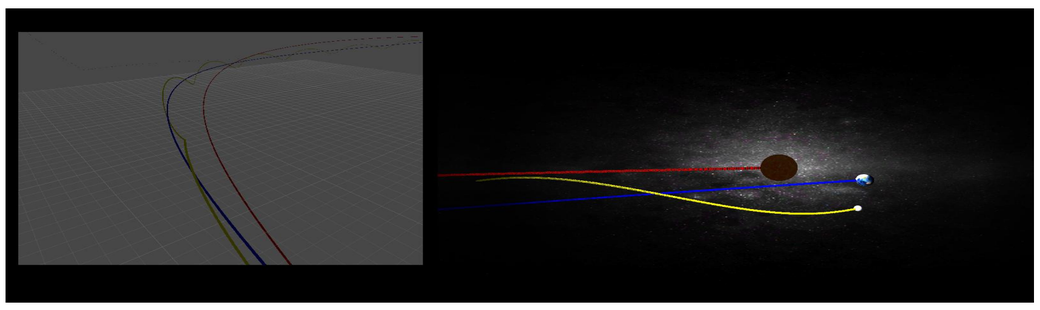
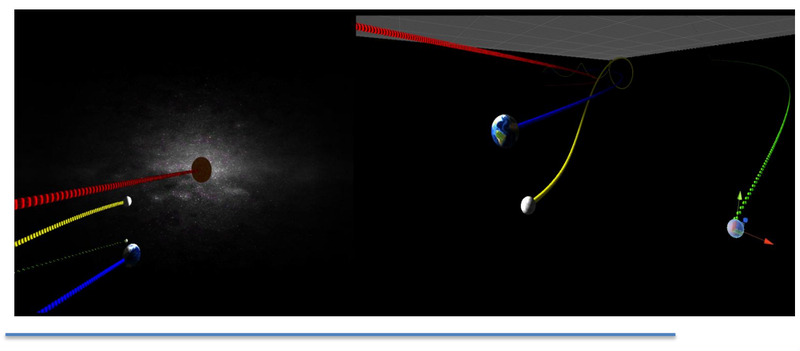
Abstract

This simulation consists of three parts : ***

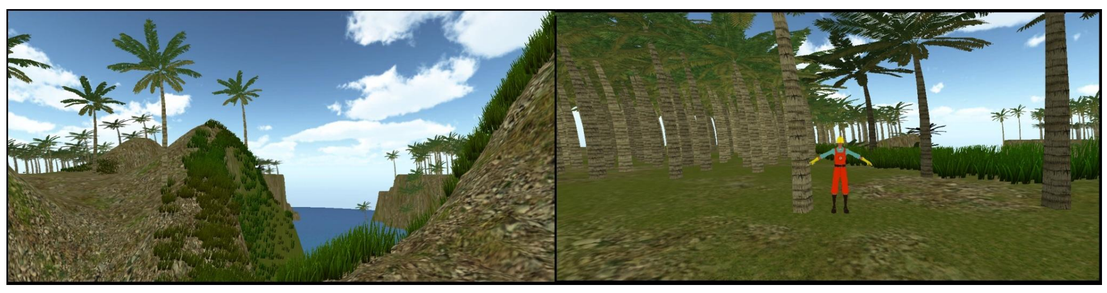
*First part: Simulating the movement of the Solar system to better understand the orbits and movements of the Sun, Earth and the Moon.



*Second part: Simulating the movements of an asteroid hitting Earth and investigating what will happen to it after entering Earth's Atmosphere.

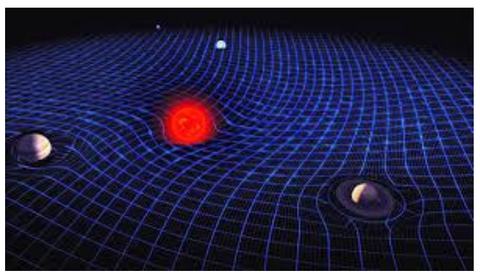


*Third part: Simulating the moment of impact (asteroid hitting earth) from a third person point of view and calculating the energy produced from impact. The needed controls are provided to change the view as needed.



Results

All things in Space-time.



If we change the speed "numbers", the simulation will be 1:1 in real time.

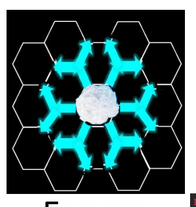
Applying Newton's Laws of Motion.

Impact could happen in two scenarios :**

*_ The speed of the asteroid is greater than the speed of Earth.

*_The path of the asteroid will intersect the path of the earth by chance.

Weight of Asteroid VS Air Resistance



Energy Dissipated In general

```
public class Energy_Dissipated : MonoBehaviour {
//impacted the earth at 30,000 mph
//density of the asteroid = 5000 kg/m3.
// the mass of the asteroid is
//(5000 kg/m3) * 3.14 (5000 m)2 * (10,000 m) = 4 x 10^15 kg
// traveling at 30,000 mph (= 1 x 104 m/sec) is
//(1/2) x (4 x 1015 kg) x (1 x 104 m/sec)2 = 2 x 1023 joule.
public float size=10000,impacted=30000f;
float Density=5000.0f;
double mass,EnergyDissipated;
void Start () {
mass=Mathf.Pow(Density,3)*3.14f*size;
// traveling at 30,000 mph (= 1 x 10^4 m/sec)
int traveling=10000;
EnergyDissipated=0.5f*mass*Mathf.Pow(traveling,2);}}
```

so that the required energy in megatons of TNT is 5 x 10^7 megatons or 50 million megatons! The time for the asteroid to impact the earth is (10,000 m)/(1 x 10^4 m/sec) = 1 sec // so that the rate of energy dissipation in watts is 2 x 10^{23} watts, or 200 billion trillion watts!!!

Conclusion

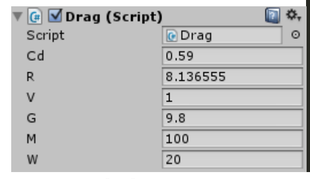
The planets in our solar system orbit around the sun. Meanwhile, our entire solar system orbits the center of the Milky Way galaxy. It takes the Sun around 250 Million years to orbit the Milky Way's center.

After simulating and studying the movements of the Solar System especially the orbits and movements of the Sun, Earth and the Moon; we conclude that the earth rotates spirally behind the sun in a circular motion and gravitates toward the sun. At the same time, the moon does the same motion with the earth. As a result, it's difficult to find a position in space that intersects the path of the Earth with that of an asteroid in a reasonable time! This does not mean that it cannot happen, it just needs tens of thousands of years to occur.

Methods

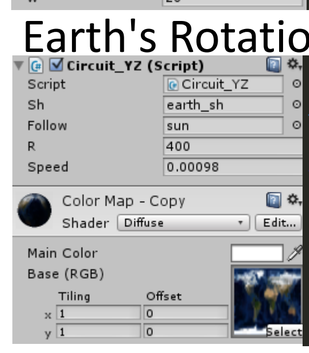
Asteroid Moving Like a Rocket

Drag (Air Resistance)




```
using UnityEngine;
using System.Collections;
public class Drag : MonoBehaviour {
// Cd: drag coefficient
// r : density
// V : velocity
// g : gravitational acceleration
// m : mass
// w : weight
// D : drag
// A : area
// a : acceleration
public float Cd,r,V,g,m,w;
private float  D,A,a;
private Vector2 newpostion;
private bool update=true;
void FixedUpdate () {
if(update) {
newpostion=this.gameObject.transform.position;
A=newpostion.y;
D=Cd*0.5f*r*V*V*A;
a=(w-D)/m;
newpostion.y+=a;
this.gameObject.transform.position=newpostion;}}}
```

Earth's Rotation




```
using UnityEngine;
using System.Collections;
public class Circuit_YZ : MonoBehaviour {
Vector3 ObjectVector,CenterVector;
public GameObject sh,follow;
public float R,speed,C=0f;
void FixedUpdate (){
    //if(C>=6.1387f){C=0.0f;count++;}
ObjectVector = this.transform.position;
CenterVector = follow.transform.position;
C = speed + C;
ObjectVector.y = R * Mathf.Cos (C) + CenterVector.y;
ObjectVector.z = R * Mathf.Sin (C) + CenterVector.z;
ObjectVector.x=CenterVector.x;
Instantiate(sh,ObjectVector,this.transform.rotation);
this.transform.position=ObjectVector;}}
```

IMAN1

Development Techniques

Unity-3D Physics Engine and C# Programming Language for simulating the orbits of the Sun, Earth, Moon, Asteroid

C programming language along with MPI to calculate the forces acting on the asteroid every second and the energy resulted from the moment of impact

This simulation required a high performance computing resource to solve the problem in reasonable time and more accurately. The simulation was done at IMAN1: Jordan's National Supercomputing Center