

# An Insight into Artificial Satellites

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Project link: <https://abhijeetamle.github.io/Satellite-Trajectory-Visualization>



# Introduction

Sputnik 1 was the first satellite in space. The Soviet Union launched it in 1957.

NASA launched America's first man-made satellite the Explorer-1 in 1958.



The first crude image taken by the satellite Explorer 6 shows a sunlit area of the Central Pacific Ocean and its cloud cover. The photo was taken when the satellite was about 17,000 mi above the surface of the earth on August 14, 1959.

# Introduction

- Usage of satellites: communication, navigation, studying planets, etc.
- Starlink constellation will include nearly 12,000 satellites once they've all launched.
- All space junk is the result of us launching objects from Earth, and it remains in orbit until it re-enters the atmosphere.
- 34,000 pieces of space junk larger than 10 centimeters
- In this project, we are visualizing active satellites

# Dataset

- Dataset is created by the Union of Concerned Scientists (UCS)
- Dataset contains 2666 active satellites
- 28 types of data for each satellite
  - Contains technical information: mass, power, launch date, expected lifetime
  - Contains orbit information: apogee, perigee, inclination, and period
  - Contains information on what the satellite is used for
  - Contains information on who owns, operates, and built the satellite.
- Dataset link: <https://www.ucsusa.org/resources/satellite-database>



# Outline of our Story

## 1. Visualization 1

- A color map showing number of satellites in all the countries

## 2. Visualization 2

- Multi-series line chart showing trends in satellites application areas

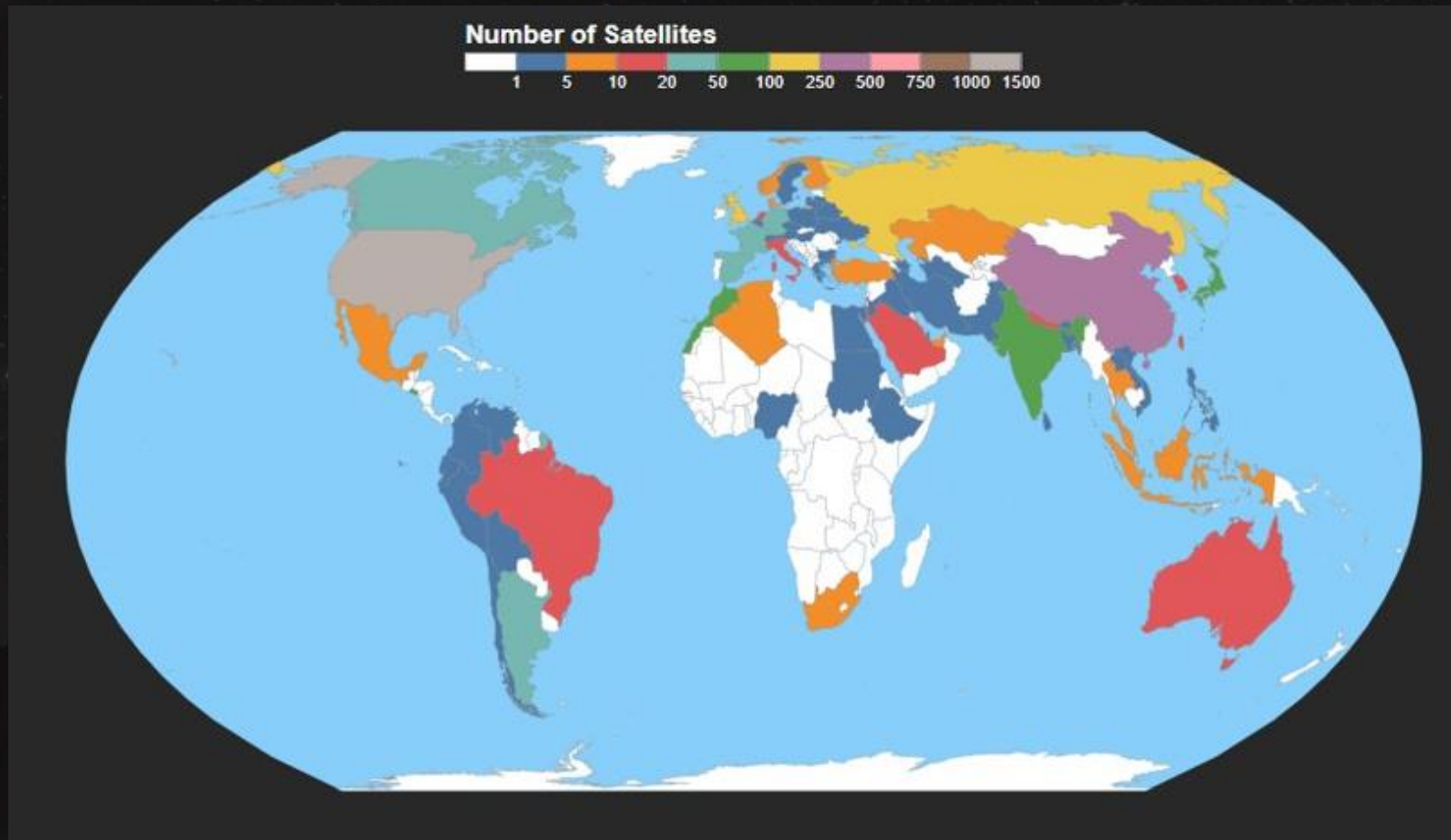
## 3. Visualization 3

- A 3-D visualization showing different types of satellite orbits around the Earth

## 4. Visualization 4

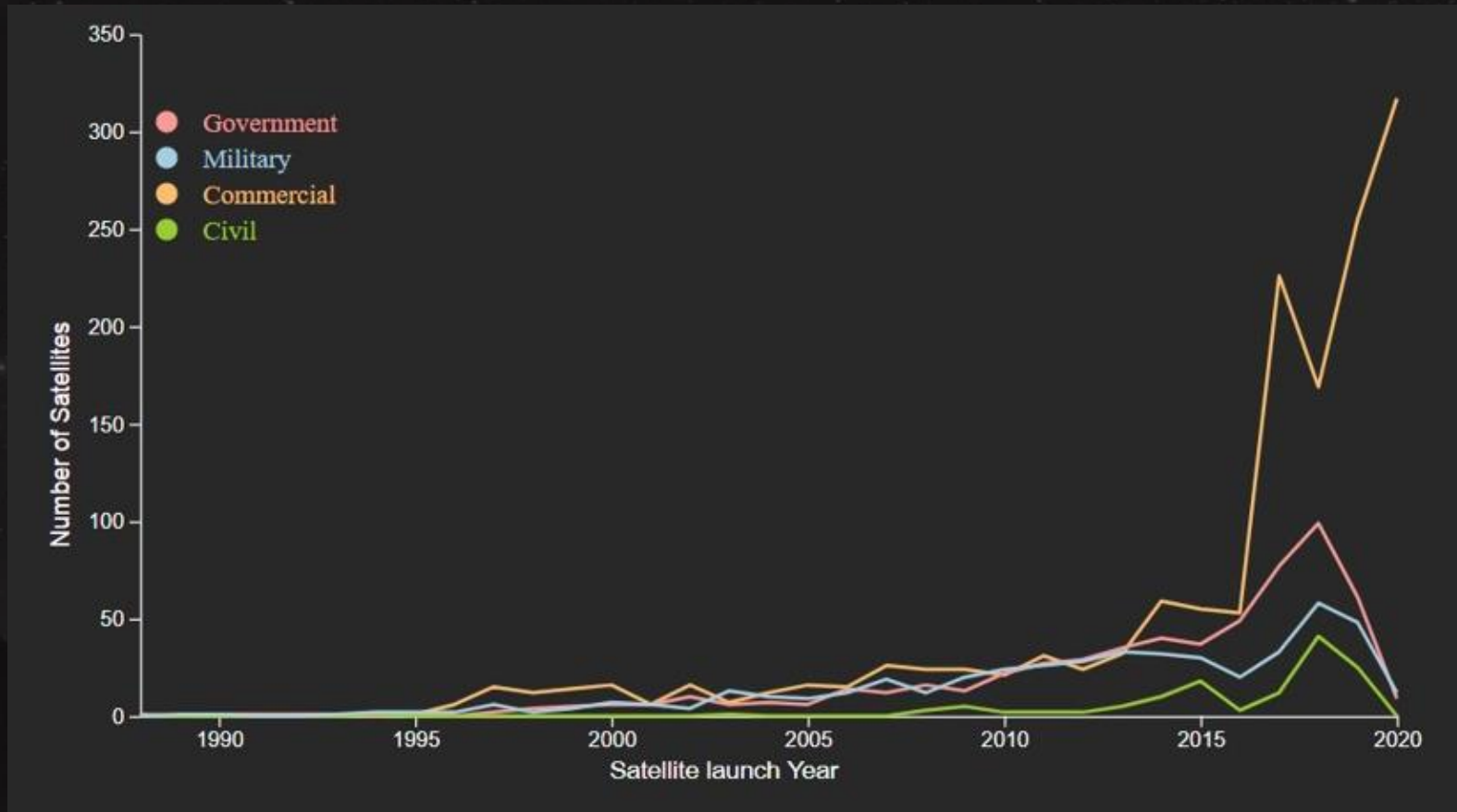
- A 3-D visualization showing all the satellites revolving around the Earth in their designated orbit

# Who's launching satellites?



- The map shows the number of satellites launched by each country
- Top three countries in number of satellites
  - USA – 1308
  - China – 356
  - Russia – 169

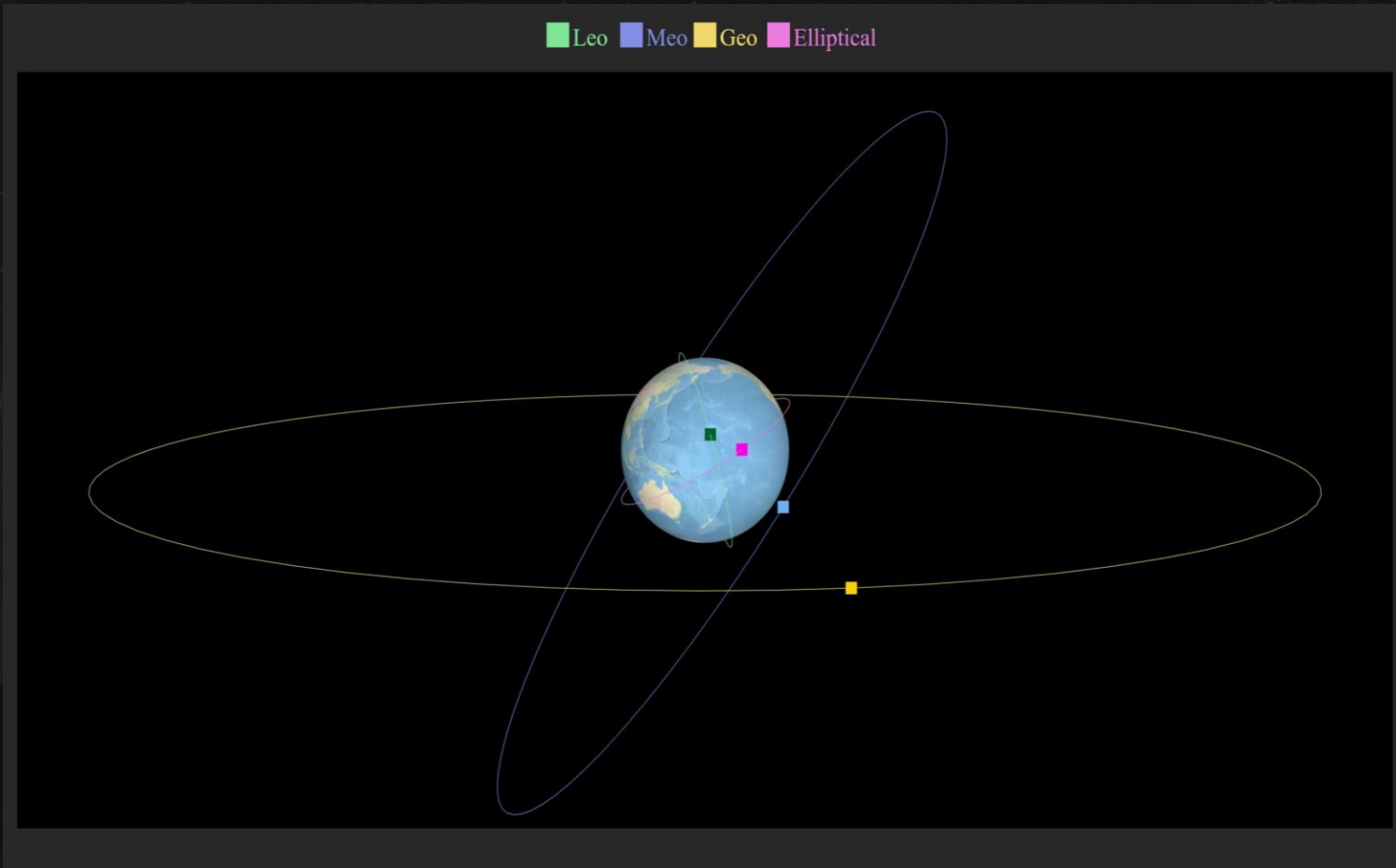
# Trends in Satellite Application Areas



- The graph represents the number of satellites launched per application area
- Recently, the number of commercially launched satellites has seen a greater spike.



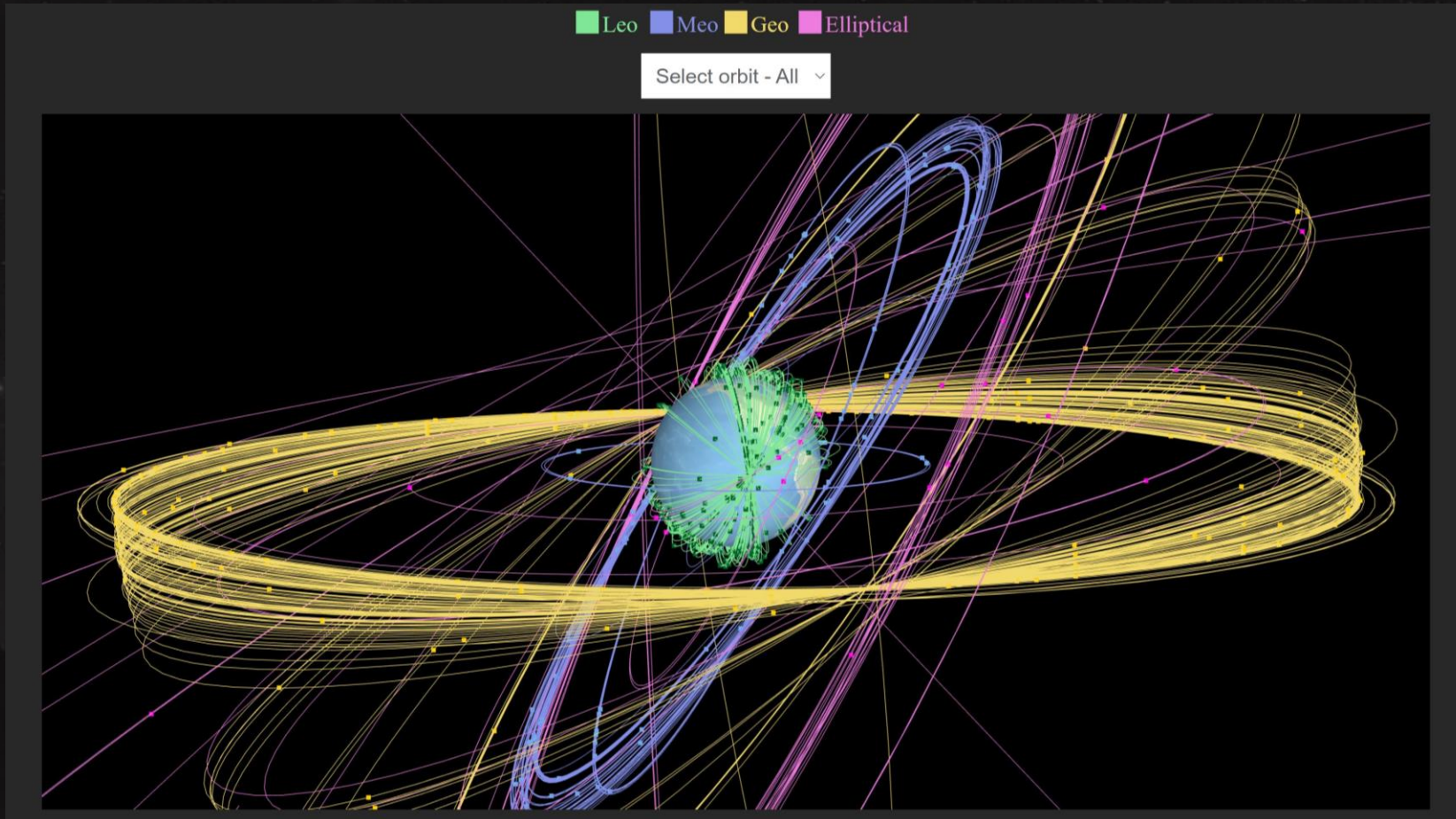
# Types of satellite orbits



- LEO – Low Earth Orbit
  - 100 to 1200 miles above Earth surface
- MEO – Medium Earth Orbit
  - 8000 miles above Earth surface
- GEO – Geostationary Earth Orbit
  - 23,000 miles above Earth surface
- Elliptical orbit
  - Satellites moves in an elliptical orbit

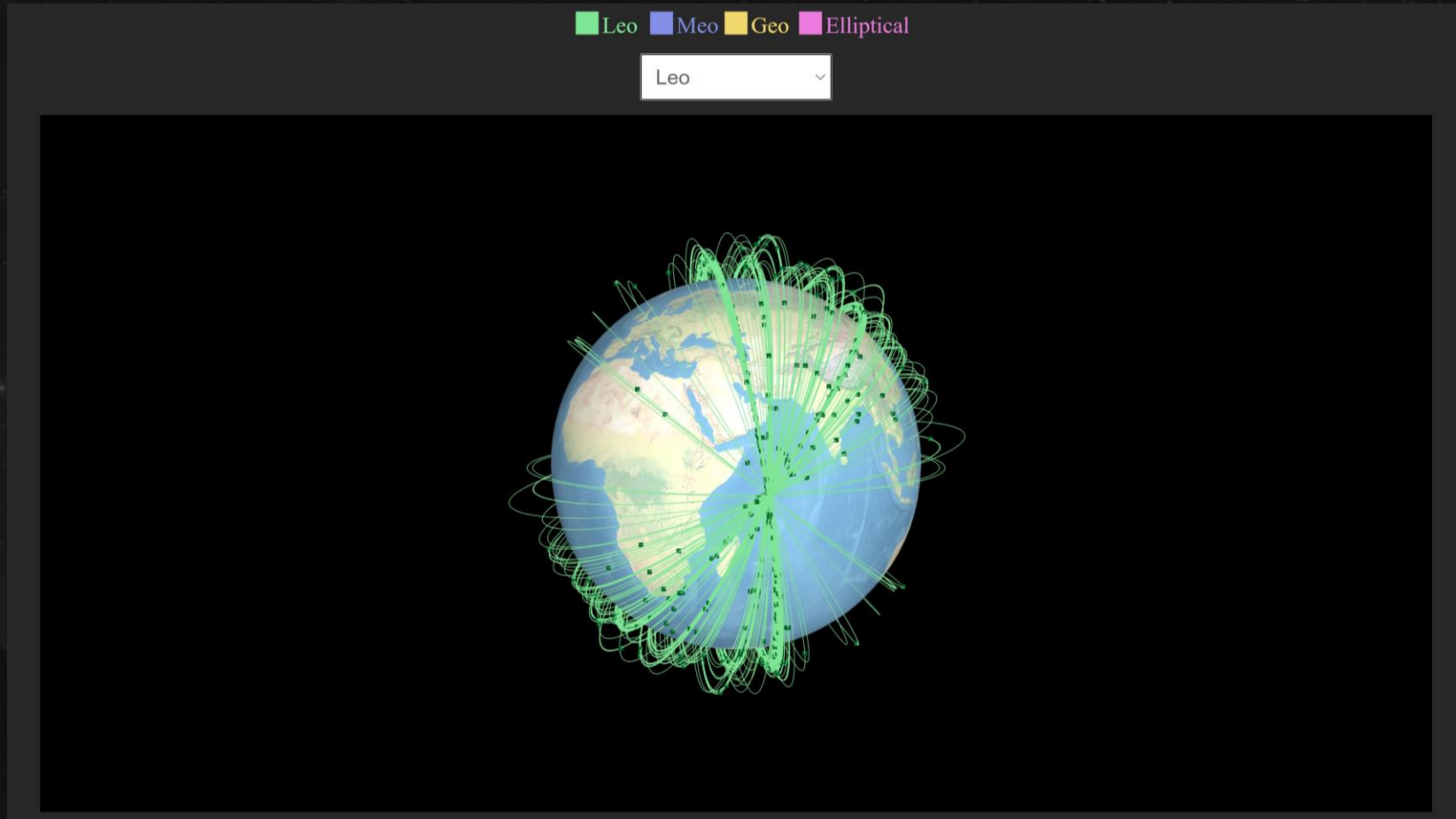


# Visualization of all Satellites



- This visualization shows how satellites with different orbits revolve around the Earth.
- We can select a particular orbit in the visualization

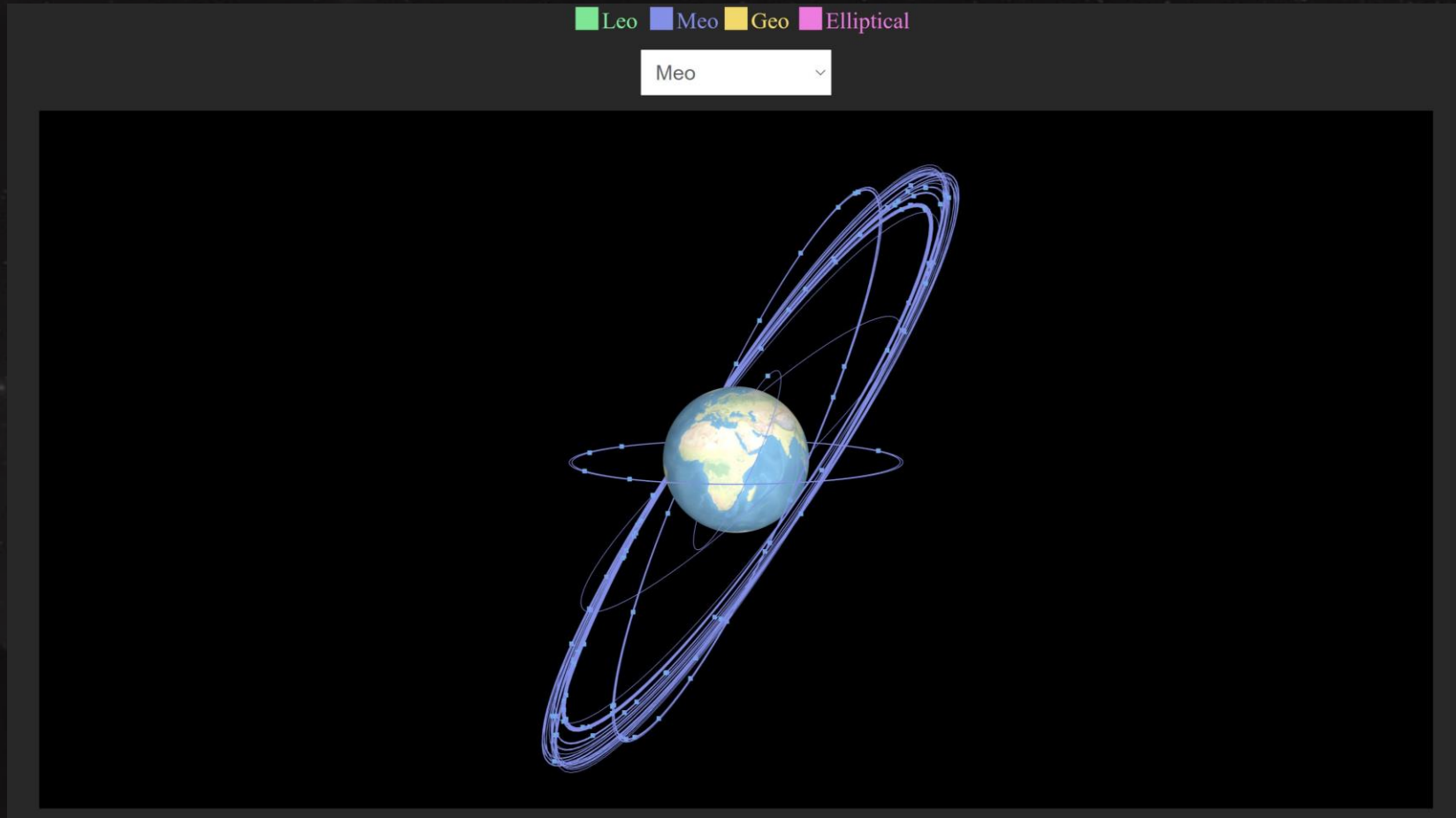
# Visualization of Satellites in LEO orbit



- One complete orbit in LEO takes about 90 minutes.
- Purpose: communications, military reconnaissance, spying and other imaging applications
- It is also the orbit used for the International Space Station (ISS)

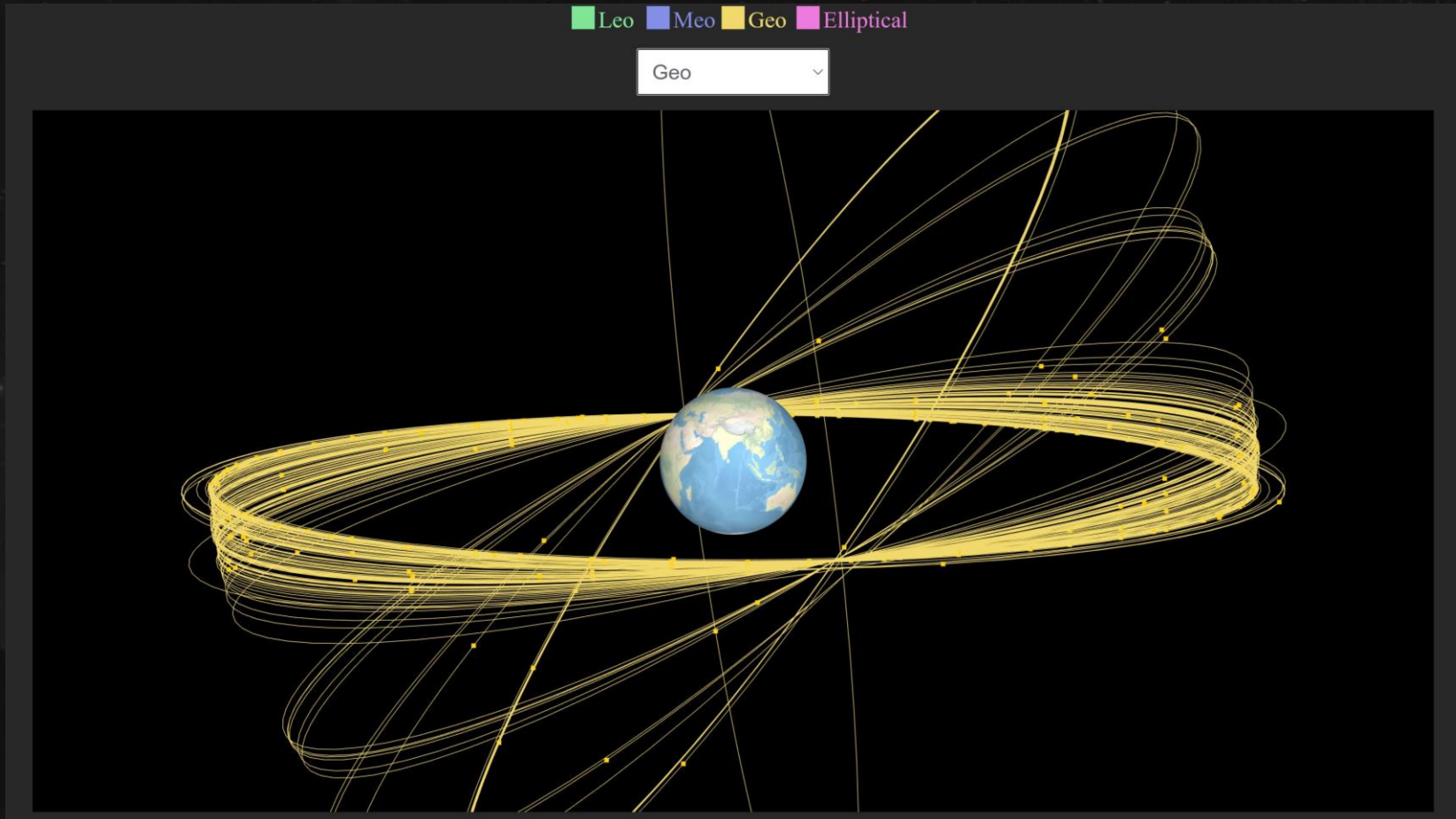


# Visualization of Satellites in MEO orbit



- One complete orbit in MEO takes about 12 hours
- Purpose:
  - Navigation
  - Communications
  - Mobile communications

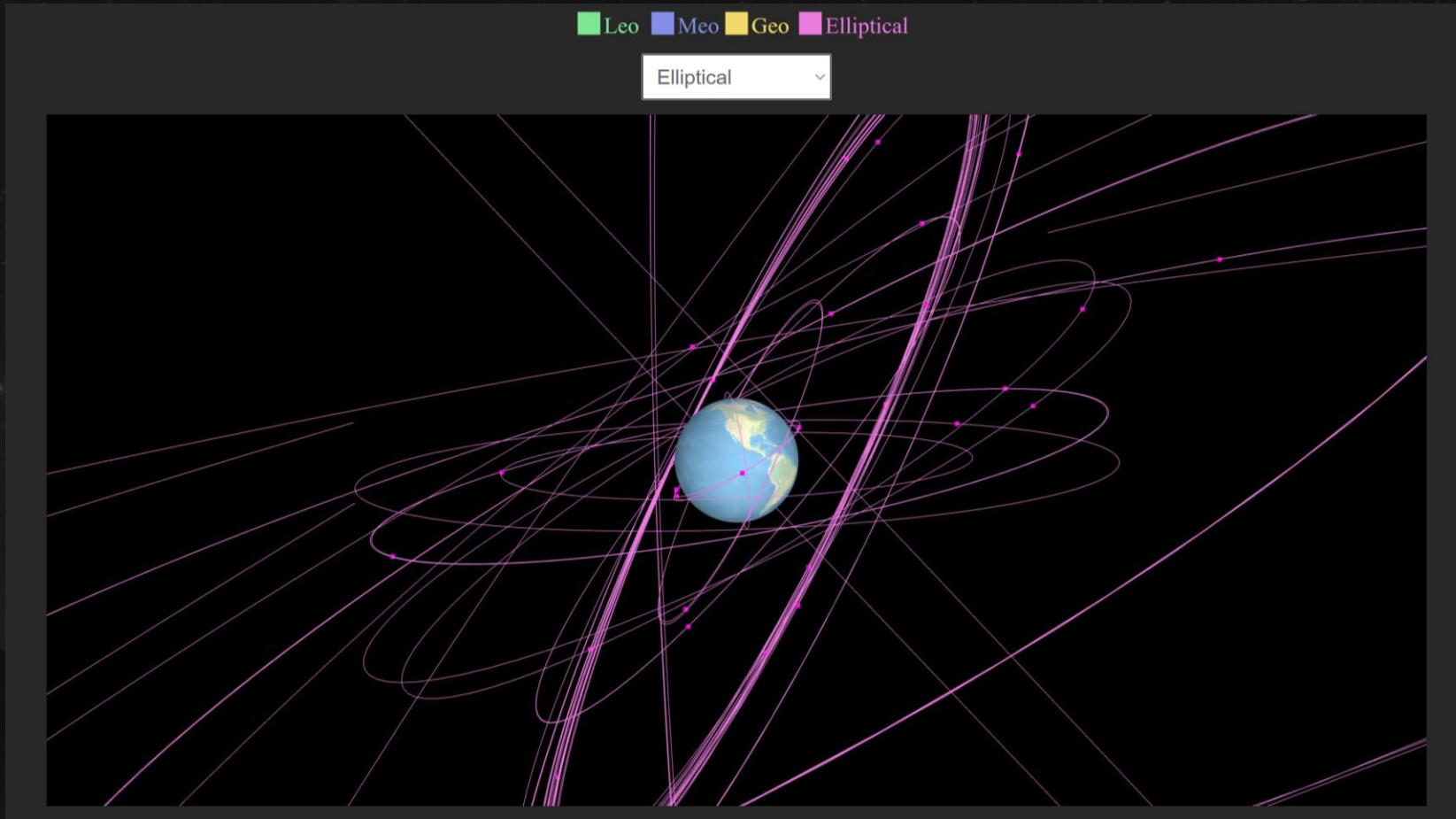
# Visualization of Satellites in GEO orbit



- It moves in the same direction and at the same rate Earth is spinning.
- Purpose: weather forecasting, atmospheric tracking, satellite radio, and television



# Visualization of Satellites in Elliptical orbit



- Satellites rotate in an elliptical orbit at different altitude, so the time taken for one complete rotation varies
- Purpose: Elliptical orbits are best suited for communications satellites, as it allows the satellite to be visible to a ground station for a long portion of its orbit and is out of contact for a shorter period of time.



THANK YOU