

The background features a deep blue gradient with a starry space pattern. On the left side, there are several white line-art diagrams of celestial bodies and orbits. These include concentric circles, elliptical paths, and circular arcs with arrows indicating direction. Some of these diagrams have numerical labels: 40, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, and 260. The main title is centered on the right side in a large, white, sans-serif font.

PROCEDURAL MODELING OF PLANETS

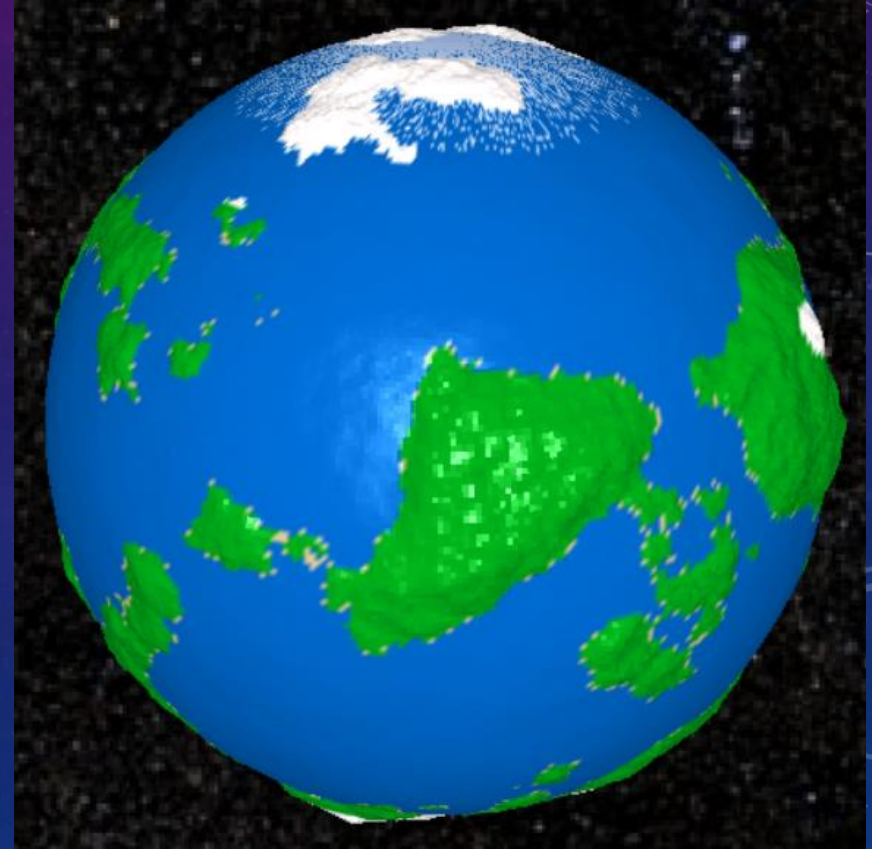
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CS 33400

APRIL 27, 2021

PLANET GENERATION

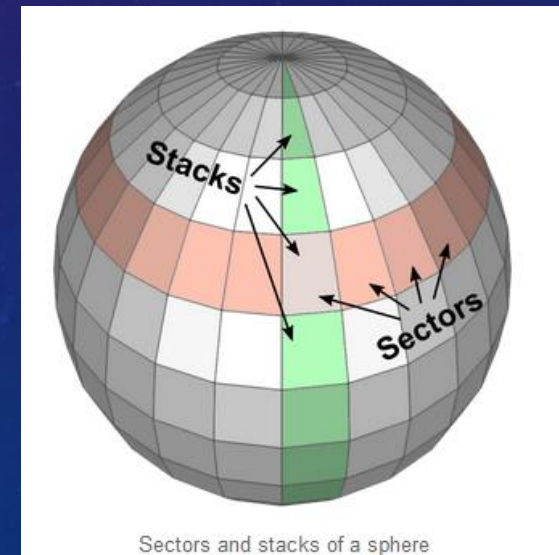
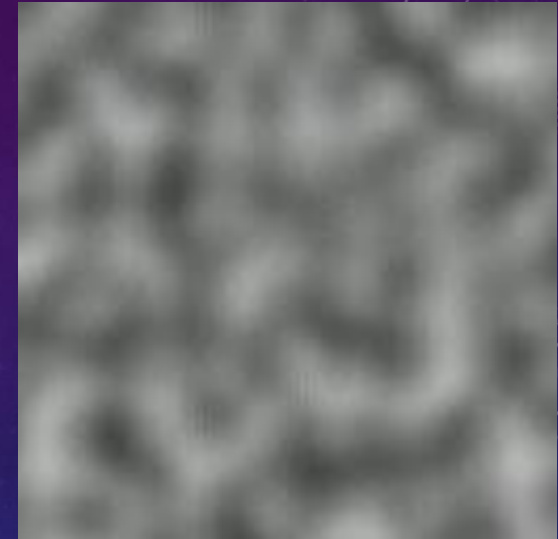
- Physics-based
- Choose parameters like size, length of day, mass, temperature, ocean level, and surface roughness
- Generate a plausible and explorable 3D model



PRIOR WORK AND INSPIRATION

I used two libraries as a base for my program:

- Ken Perlin's Perlin Noise (1983)
- Song Ho's OpenGL Sphere



MY APPROACH

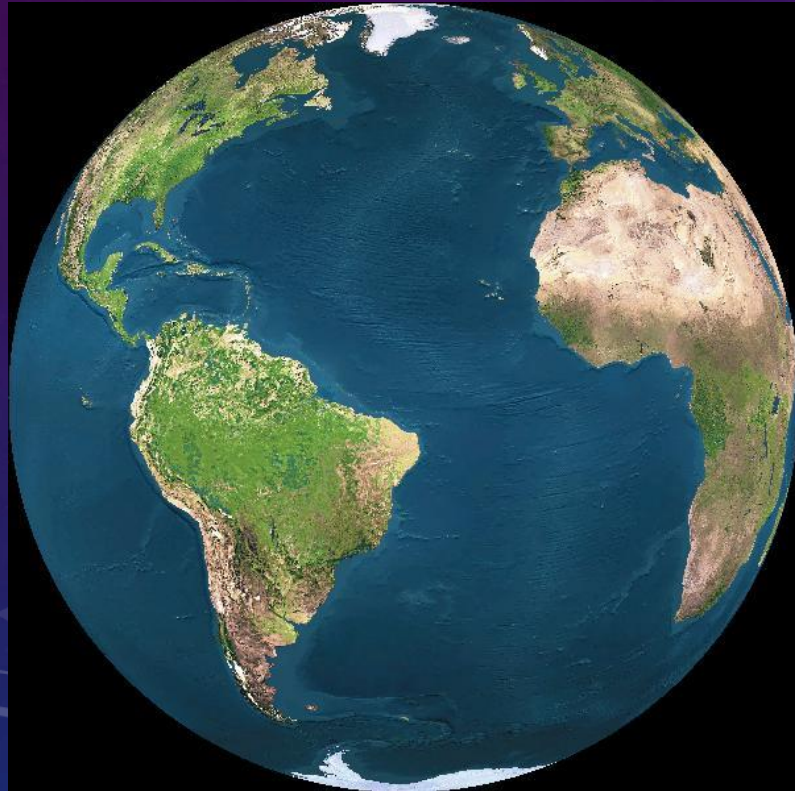
```
# This is an example planet grammar for an Earth-like planet
# It has the same dimensions and properties, but with procedurally generated terrain

# Polar radius (in km)
R 6357
# Mass (in kg)
M 5.9722e24
# Sidereal day (in hours)
D 23.93
# Smoothness factor of planet surface (0->1, 0 is a sphere)
S 0.1
# Average sea-level temperature at 45 deg latitude (C)
T 15
# Water level (% of planet covered, 0 for planet without water)
W 0.57
# General planet coloring. options are:
#     terrestrial : green and sandy
#     random      : a fun new color
#     color       : specify a color (follow with 3 RGB values)
C terrestrial
```

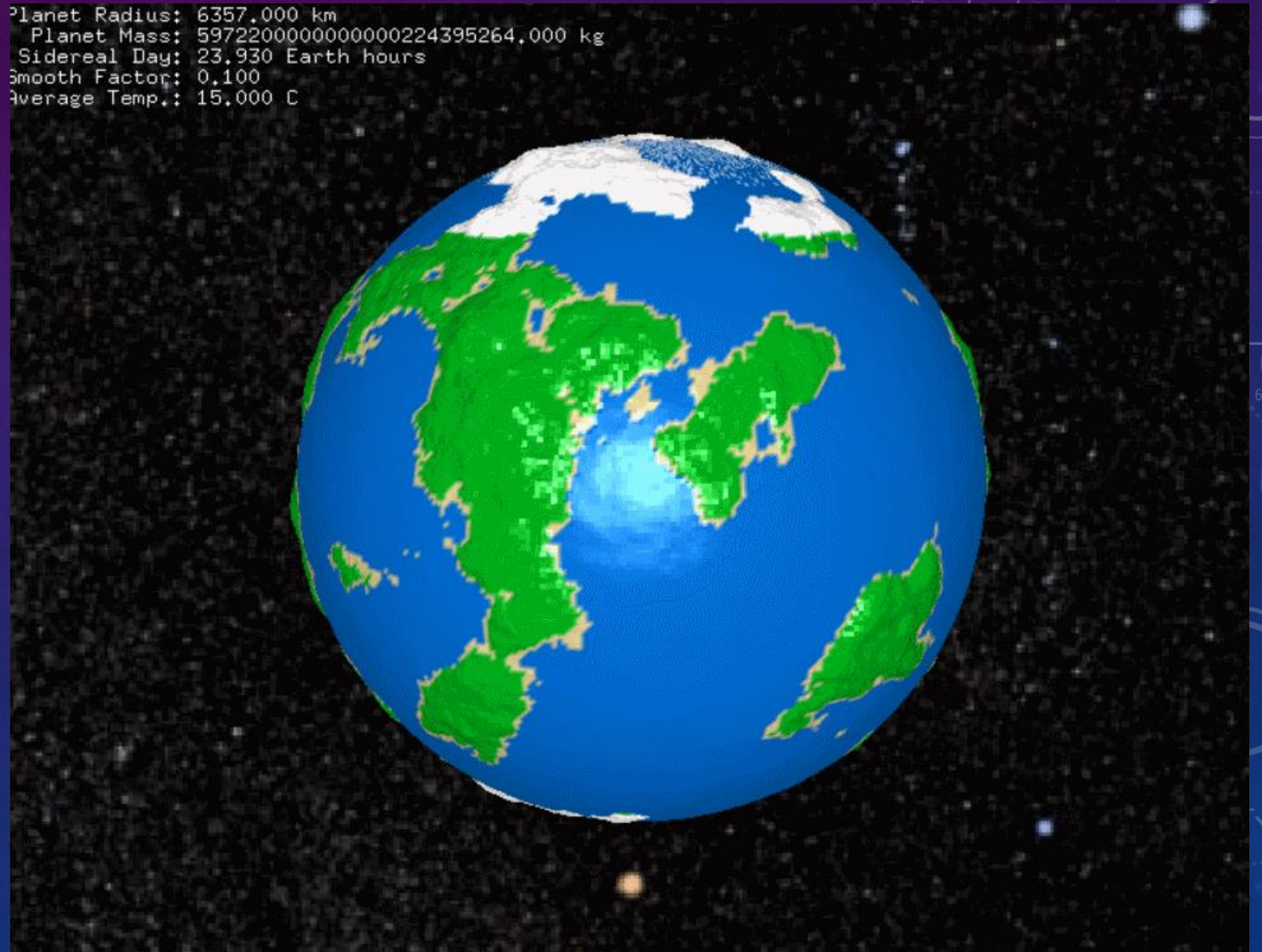
- Create input file containing planet grammar
- Generate surface height through layered Perlin noise
- Generate planet shape by calculating oblateness due to rotation and orbit
- Calculate oceans, ice, and snow based on water level and local temperature
- Explore using OpenGL

RESULTS

EARTH

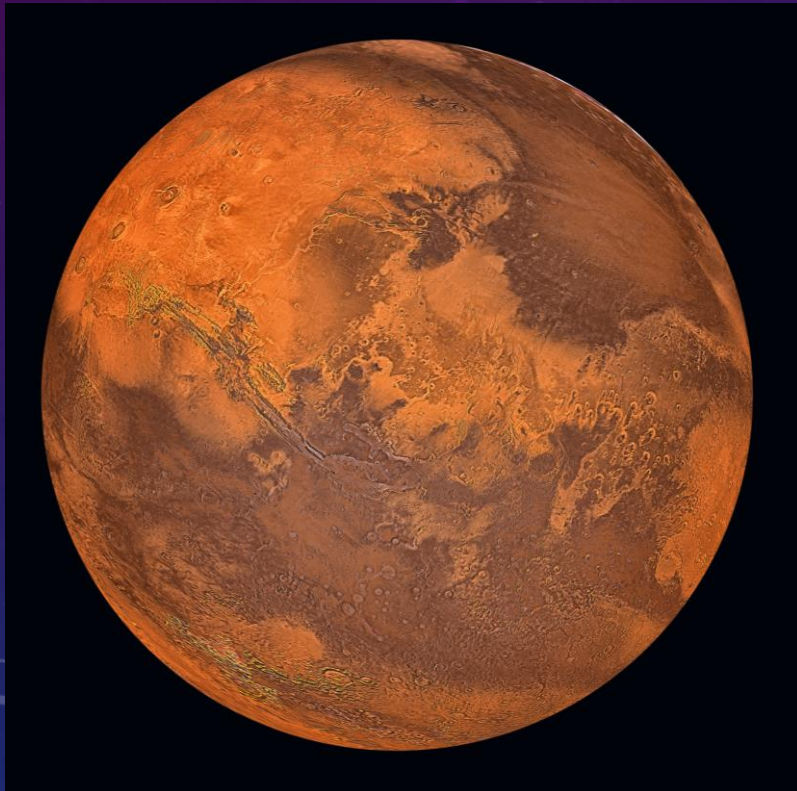


Planet Radius: 6357.000 km
Planet Mass: 597220000000000224395264.000 kg
Sidereal Day: 23.930 Earth hours
Smooth Factor: 0.100
Average Temp.: 15.000 C

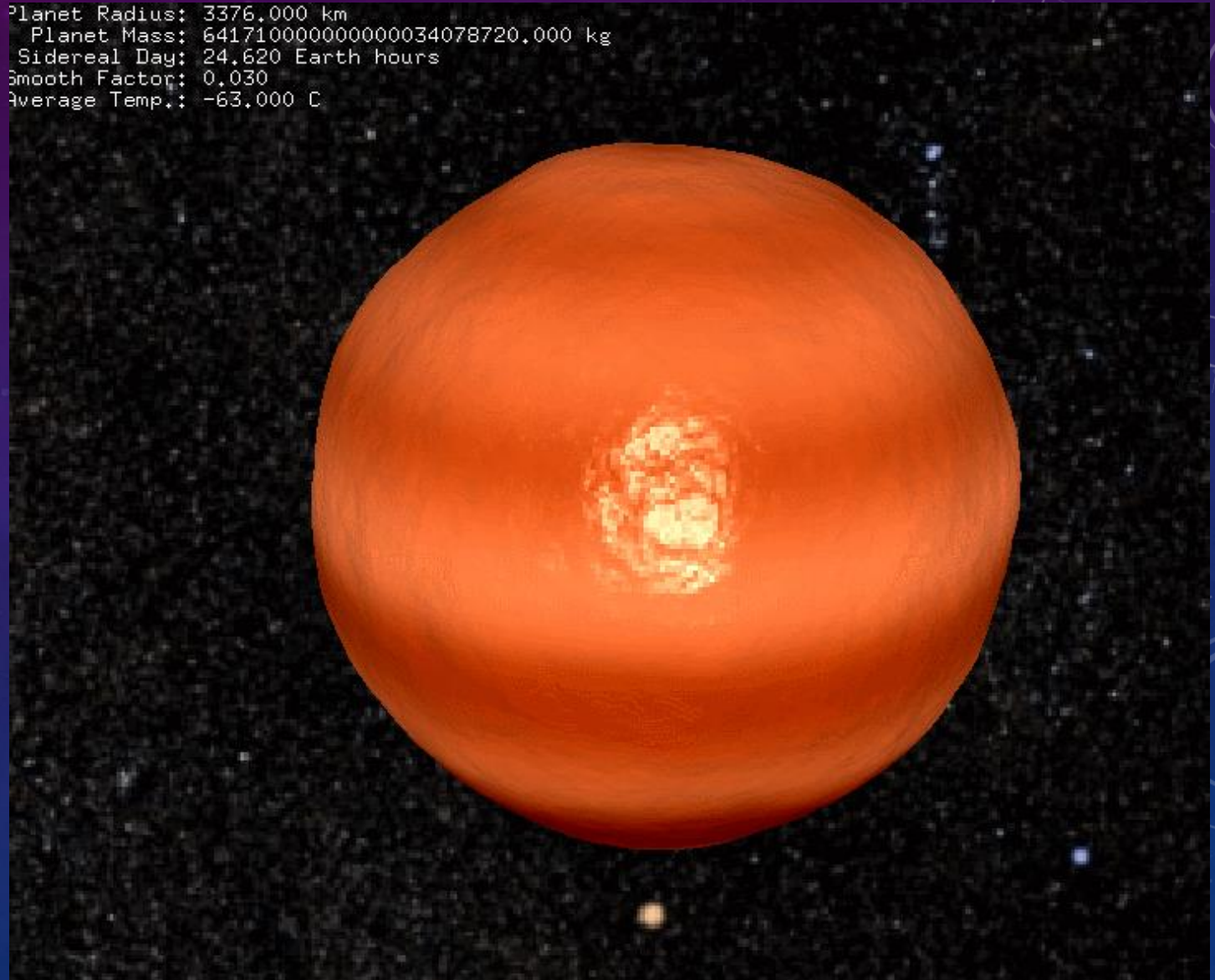


RESULTS

MARS

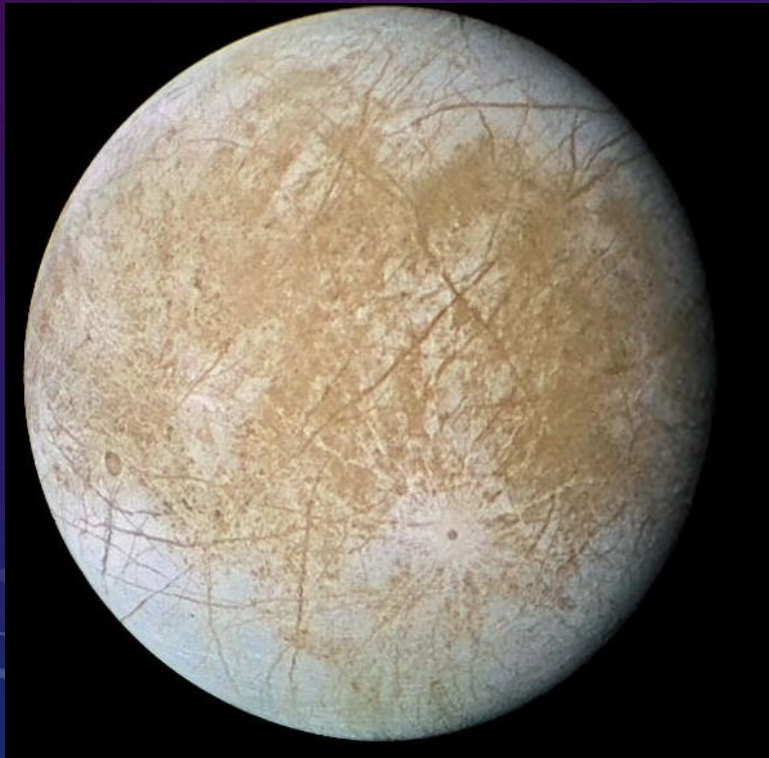


Planet Radius: 3376.000 km
Planet Mass: 64171000000000034078720.000 kg
Sidereal Day: 24.620 Earth hours
Smooth Factor: 0.030
Average Temp.: -63.000 C



RESULTS

EUROPA

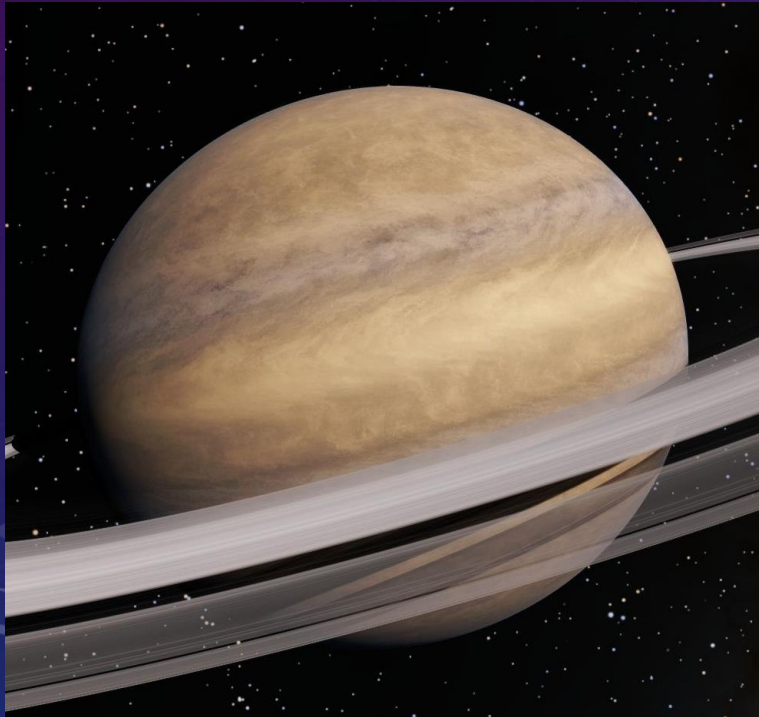


Planet Radius: 1560,000 km
Planet Mass: 47800000000000002097152,000 kg
Sidereal Day: 84,980 Earth hours
Smooth Factor: 0,020
Average Temp.: -171,000 C

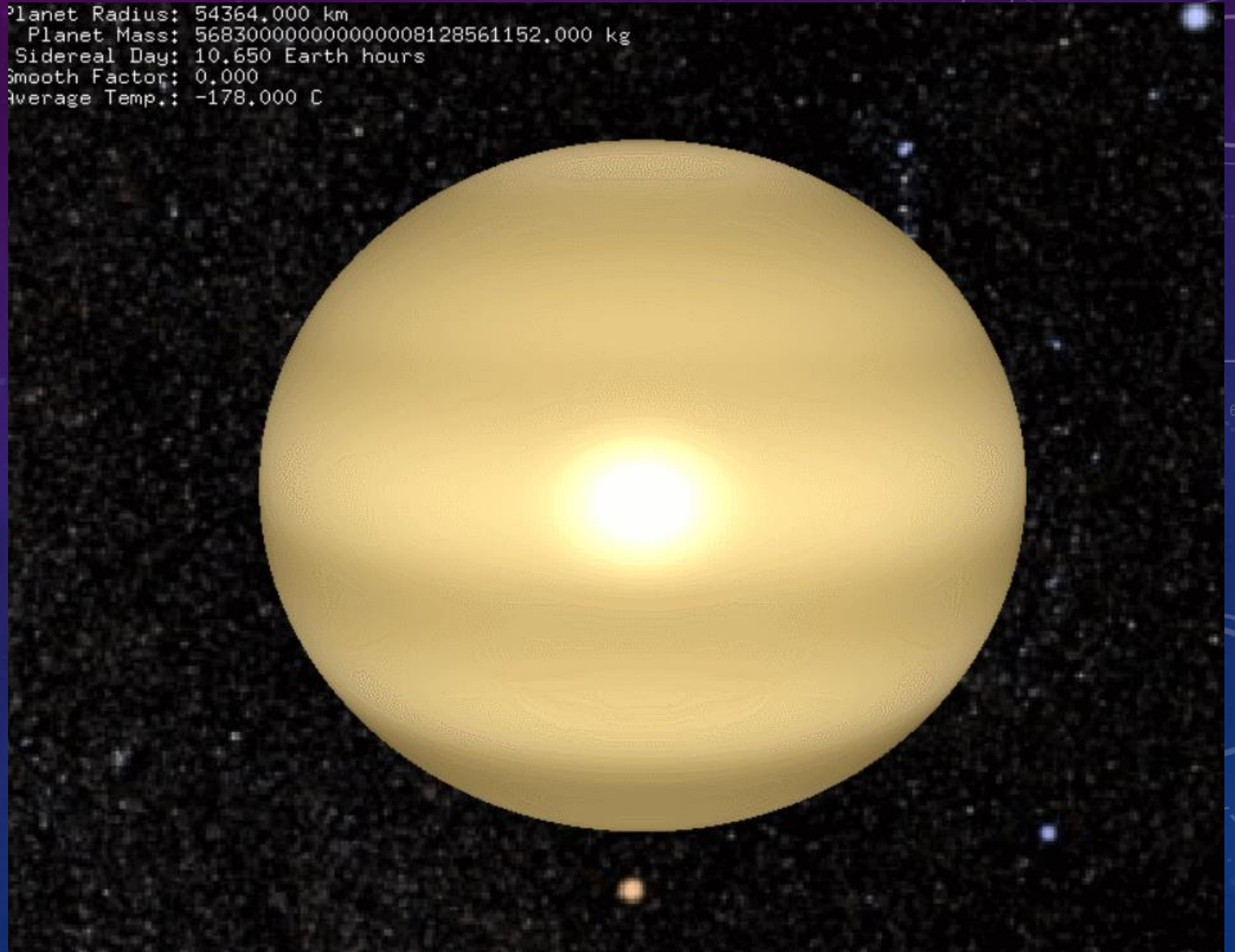


RESULTS

SATURN

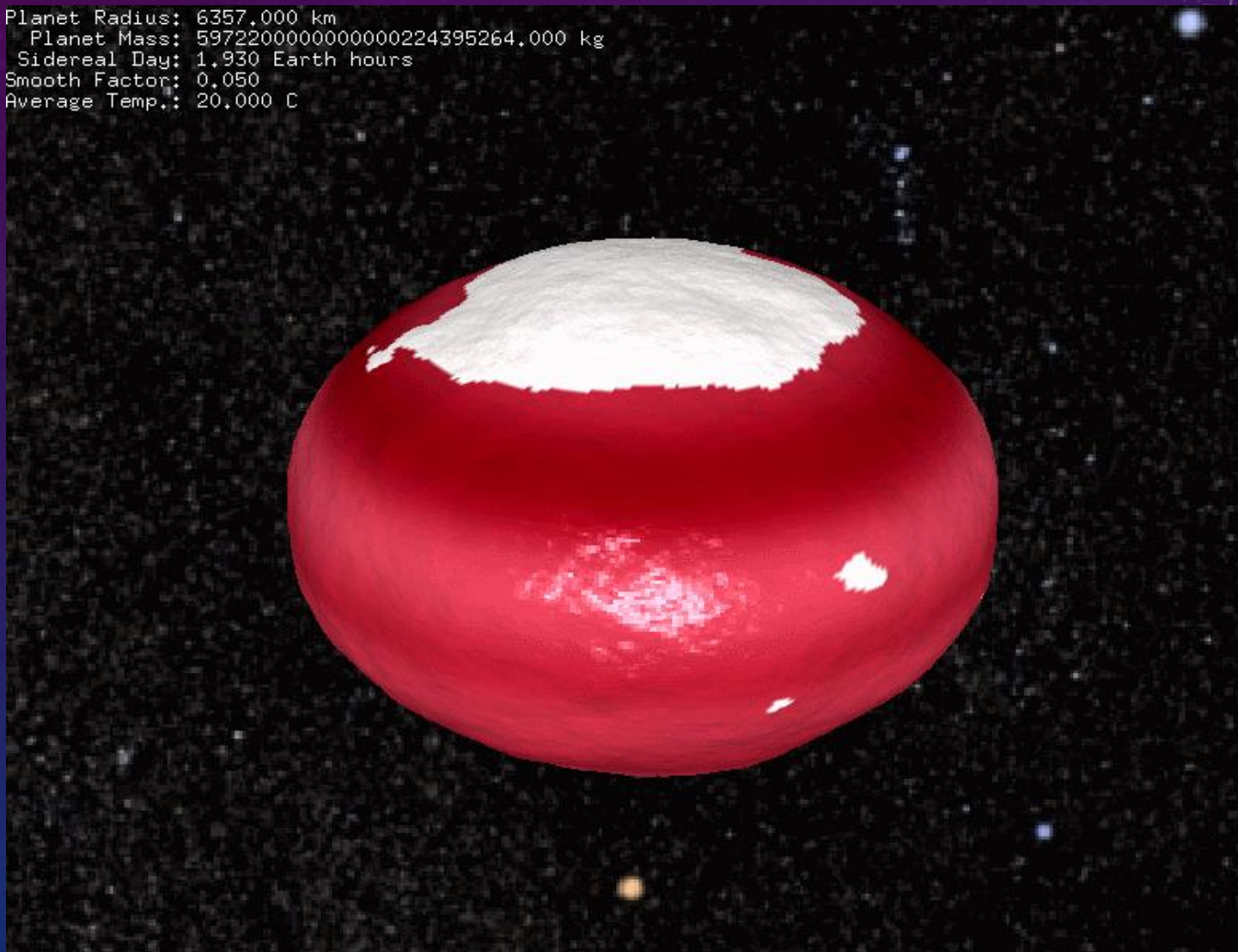


Planet Radius: 54364.000 km
Planet Mass: 568300000000000008128561152.000 kg
Sidereal Day: 10.650 Earth hours
Smooth Factor: 0.000
Average Temp.: -178.000 C



RESULTS

Planet Radius: 6357.000 km
Planet Mass: 597220000000000224395264.000 kg
Sidereal Day: 1.930 Earth hours
Smooth Factor: 0.050
Average Temp.: 20.000 C



The background is a gradient of deep purple and blue, speckled with white dots. On the left side, there are several white circular and semi-circular patterns. A prominent circular scale with degree markings from 140 to 260 is visible. Other smaller circles and arcs, some with arrows, are scattered across the left half of the image.

DEMO

The background is a gradient of dark blue and purple, speckled with small white dots. On the left side, there are several concentric circles and a large circular scale with degree markings from 140 to 260. Some circles have arrows indicating a clockwise direction. The word "QUESTIONS?" is written in white, sans-serif capital letters on the right side.

QUESTIONS?