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Grok 2 + FLUX beta

Please calculate the following information and provide the information requested. 1. At what altitude does "space/vacuum" begin? 2. Satellites in geosynchronous orbit with earth, say in florida would have to be traveling at what speeds in MPH at an altitude of 60 miles up?

Answer

Here are the answers to your questions:

1. **Altitude where "space/vacuum" begins:**
   - The commonly accepted boundary where space begins is known as th **Kármán line**, which is approximately **100 kilometers (62 miles)** abov the Earth's sea level. However, this is somewhat arbitrary; practically, atmosphere does not abruptly end but gradually thins out, leading to various definitions. For instance, the U.S. recognizes **50 miles (80 km** the boundary for astronaut wings.

2. **Speed of satellites in geosynchronous orbit at 60 miles altitude:**
   - **Geosynchronous orbit** requires satellites to orbit at the same rate as Earth rotates, meaning they complete one orbit in exactly 24 hours. However, this specific orbit is not at 60 miles but rather at an altitude approximately **35,786 kilometers (22,236 miles)** above the equator. this altitude, satellites travel at about **6,876 mph (11,068 km/h)**.
   - At an altitude of **60 miles (96.56 km)**, you're talking about a much lov orbit, typically within the lower part of the Low Earth Orbit (LEO). Here
     - The orbital speed for an object at this altitude can be calculated using the formula for orbital velocity:

$$v = \sqrt{\frac{GM}{r}}$$

where:
- v is the orbital velocity,
- G is the gravitational constant ($6.67430 \times 10^{-11}\ m^3\ kg^{-1}\ s^{-2}$),
- M is the mass of Earth (approximately 5.972×10^{24} kg),

Kármán line significance t Low Earth Orbit uses f simplify speed calculation

Ask anything

$$v = \sqrt{\frac{6.67430 \times 10^{-11} \times 5.972 \times 10^{24}}{6,467,560}} \approx 7,840\ \text{m/s}$$

Converting to mph:

$$7,840\ \text{m/s} \times \frac{3600}{1609.34} \approx 17,487\ \text{mph}$$

So, for a satellite at 60 miles altitude, the speed would be roughly **17,487 r** Keep in mind, this altitude is not practical for geosynchronous orbits but rather for very low Earth orbits where atmospheric drag would be significa leading to rapid orbital decay without continuous propulsion.

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