Problem 61

Roughly how many solar systems would it take to tile the disk of the Milky Way?

Solution

The diameter d_S of the solar system is 10^{13} m, and the diameter d_M of the Milky Way is 10^{21} m. The area of a circle is

$$A = \pi r^2 = \pi \left(\frac{d}{2}\right)^2 = \frac{\pi d^2}{4}.$$

Divide the area of the Milky way by the area of the solar system.

$$\frac{A_M}{A_S} = \frac{\frac{\pi d_M^2}{4}}{\frac{\pi d_S^2}{4}} = \frac{d_M^2}{d_S^2} = \frac{10^{42}}{10^{26}} = 10^{16}$$

Therefore, it takes roughly 10^{16} solar systems to tile the disk of the Milky Way.