Answer:

The probability is just the ratio of the volume occupied by stars to the total volume of the galaxy:

[ly = light year]

Volume of galaxy = $\frac{4}{3}\pi\, r^3 = \frac{4}{3}\pi \times (10^5 \text{ ly})^3$

$$= \frac{4}{3}\pi \times 10^{15} \text{ ly}^3$$

Volume occupied by stars = number of stars × volume of a star

$$= 200\times 10^9 \times \frac{4}{3}\pi \times (6.96\times 10^{10} \text{ cm})^3$$

$$= \frac{4}{3}\pi \times 2\times 10^{41} \times (6.96)^3 \text{ cm}^3$$

Both volumes need to be in the same units:

$$1 \text{ ly} = 9.47\times 10^{17} \text{ cm}$$

$$\text{Volume of galaxy} = \frac{4}{3}\pi \times 10^{15} \times (9.47\times 10^{17}\text{ cm})^3$$

$$= \frac{4}{3}\pi \times 10^{66} \times (9.47)^3 \text{ cm}^3$$

Finally find the probability:

$$\text{Probability} = \frac{\text{volume occupied by stars}}{\text{volume of galaxy}} = \frac{\frac{4}{3}\pi \times 2\times 10^{41} \times (6.96)^3}{\frac{4}{3}\pi \times 10^{66} \times (9.47)^3}$$

$$\approx \frac{10^{44}}{10^{69}} = 10^{-25}$$

The galaxy is almost empty.