Are the Stars Distant Suns?

If a star had the same luminosity as the sun, but was a million times farther away, its apparent brightness would be

$$\frac{\ell_{star}}{\ell_{sun}} = \frac{L_{star}}{L_{sun}} \times \left(\frac{R_{sun}}{R_{star}} \right)^2 = 1 \times \left(\frac{1AU}{10^6 AU} \right)^2 = 10^{-12}$$

times that of the sun.

Are the stars distant suns? Table 1 gives the distances to three nearby stars, as well as the ratios between their luminosity and apparent brightness and that of the sun. As the distances calculated from parallax angles show, these stars certainly are distant, being on the order of a million times farther away from us than the sun. A star just like the sun, but a million times farther away, would have an apparent brightness about one trillionth that of the sun. The apparent brightnesses of the three stars in the table are all approximately within an order of magnitude of one trillionth. Therefore, it would be safe to say that the stars are something like distant suns.

Table 1. Distance and brightness of three nearby stars

Star	6-month parallax angle (degrees)	Distance (AU)	$\frac{\ell_{star}}{\ell_{sun}}$	$\frac{L_{star}}{L_{sun}}$
61 Cygni	1.63×10^{-4}	7.02×10^{5}	2.47×10^{-13}	0.12
Vega	6.8×10^{-5}	1.68×10^{6}	2.00×10^{-11}	48.0
α Centauri	4.16×10^{-4}	2.75×10^{5}	2.68×10^{-11}	2.03

On the other hand, we read on page 311 that the luminosities of the stars range from 10^5 down to 10^{-4} times that of the sun, so some stars are not very similar to the sun at all, having very different luminosities!