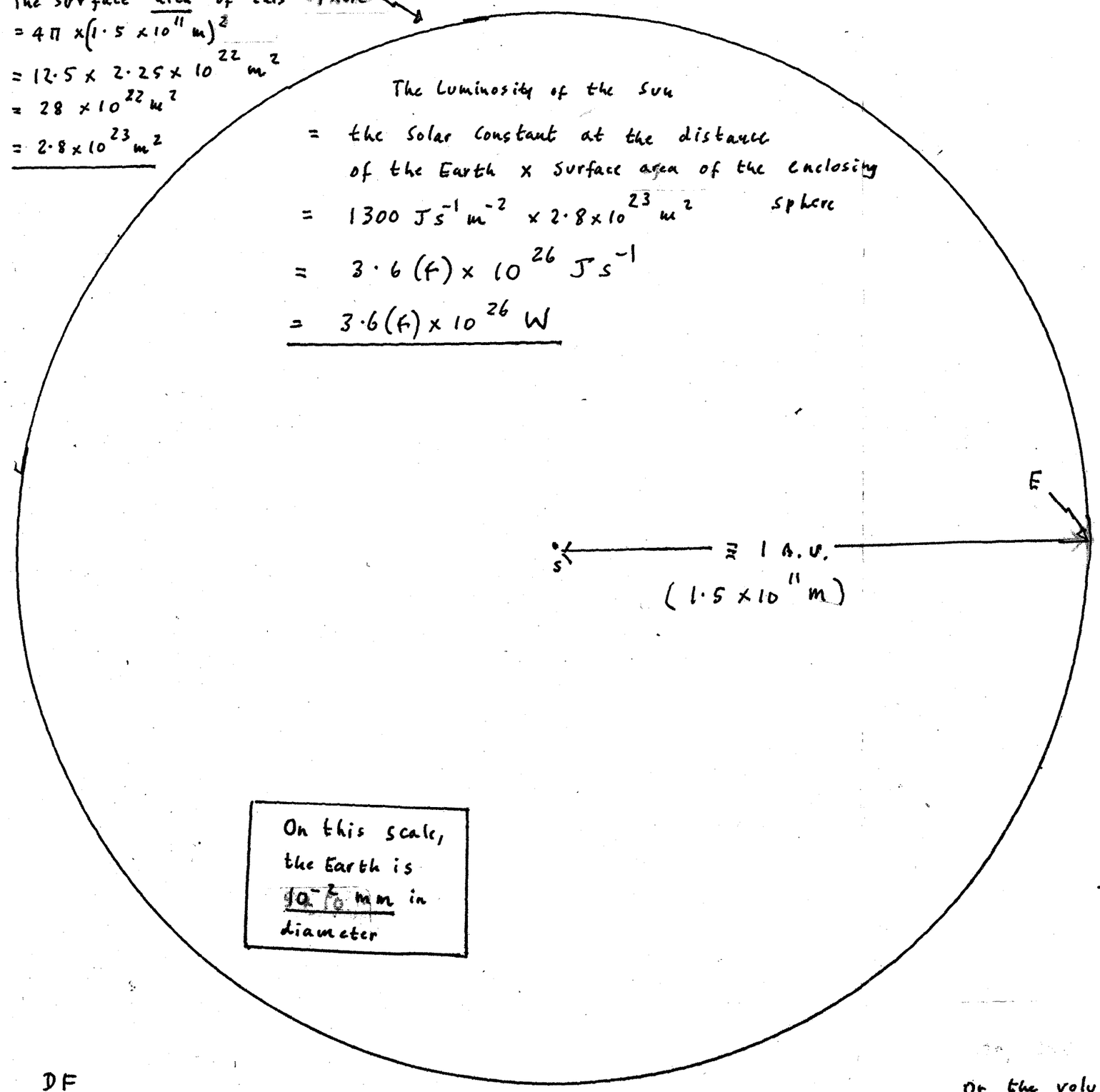
In connexion with our calculation of the Luminosity of the Sun.

The surface area of this sphere
$= 4\pi \times (1 \cdot 5 \times 10^{11}\ m)^2$
$= 12 \cdot 5 \times 2 \cdot 25 \times 10^{22}\ m^2$
$= 28 \times 10^{22}\ m^2$
$= 2 \cdot 8 \times 10^{23}\ m^2$

The Luminosity of the Sun
= the Solar Constant at the distance of the Earth × Surface area of the enclosing sphere
$= 1300\ J s^{-1} m^{-2} \times 2 \cdot 8 \times 10^{23}\ m^2$
$= 3 \cdot 6\,(f) \times 10^{26}\ J s^{-1}$
$= 3 \cdot 6\,(f) \times 10^{26}\ W$



On this scale, the Earth is 10^{-2} mm in diameter

The radius of the Sun, on this diagram, is equivalent to 0·5 mm. That is, its diameter is equivalent to 1 mm. On this scale, the Astronomical Unit is roughly 100 Solar Diameters. This is 200 Solar Radii.

Consider a hollow sphere of radius 1 A.U., encircling / enclosing the Sun.

The volume of this sphere is

$$\frac{4}{3}\pi \times \left(200\ R_\odot\right)^3 \quad \text{——— ①}$$

Now, the volume of the Sun is

$$\frac{4}{3}\pi \left(R_\odot\right)^3 \quad \text{——— ②}$$

Divide expression ② by expression ①:

$$\frac{\frac{4}{3}\pi \times \left(200\ R_\odot\right)^3}{\frac{4}{3}\pi \times \left(R_\odot\right)^3}$$

This reduces to:

$$\frac{\left(2 \times 10^2\right)^3}{1}$$

$$= \frac{8 \times 10^6}{1}$$

Or, the volume occupied by the Sun is $\frac{1}{8{,}000{,}000}$ of that of the enclosing sphere.

DF
2018, February 23