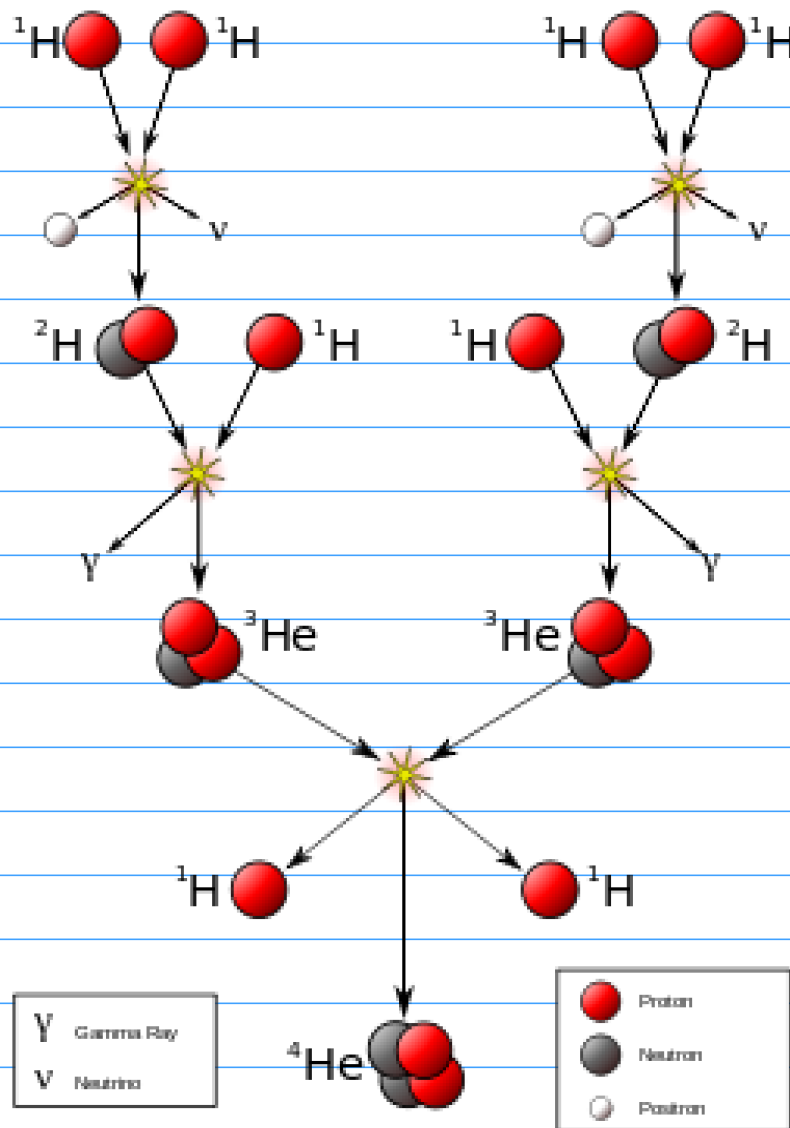


ONCE THE STAR REACHES THE MAIN SEQUENCE STAGE ITS FURTHER EVOLUTION DEPENDS ON ITS MASS.

IF THE MASS OF THE CONTRACTING CLUMP IS LESS THAN $\frac{1}{12} M_{\odot} = 0.08 M_{\odot}$ ITS CORE NEVER GETS HOT ENOUGH TO FUSE HYDROGEN INTO HELIUM (IT DOES NOT REACH THE MAIN SEQUENCE STAGE). IT FORMS SO-CALLED BROWN DWARF.

LOW MASS STARS: $0.08 M_{\odot} \leq M < 0.5 M_{\odot}$
↑
MASS OF THE STAR

THEY FUSE HYDROGEN INTO HELIUM VIA SO-CALLED PROTON-PROTON (P-P) CHAIN:



THE NET RESULT IS: $6 - 2 = 4$ PROTONS ARE FUSED INTO THE NUCLEUS OF ${}^4\text{He}$ WITH RELEASE OF ENERGY (PHOTONS AND NEUTRINOS). THE MASS OF ${}^4\text{He}$ IS SLIGHTLY LESS THAN THE TOTAL MASS OF FOUR PROTONS USED TO MAKE IT.

THE MASS DIFFERENCE

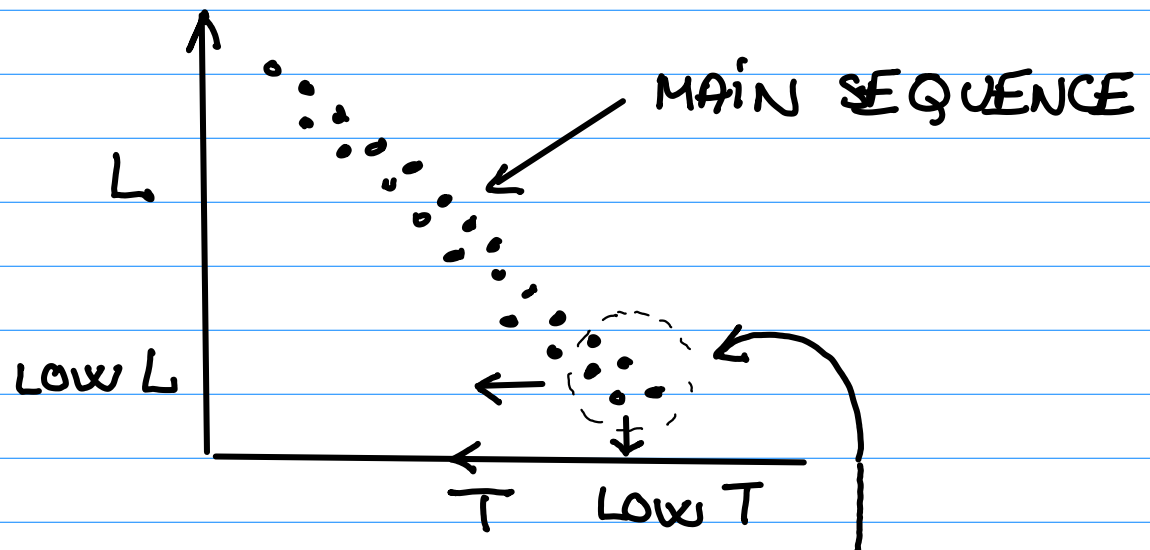
$$m = 4 \cdot \text{MASS OF } ^1\text{H} - \text{MASS OF } ^4\text{He}$$

IS CONVERTED TO ENERGY ACCORDING TO THE EINSTEIN'S RELATION

$$E = mc^2$$

→ ENERGY ← THE SPEED OF LIGHT IN VACUUM

BECAUSE OF THEIR LOW MASS THEIR LUMINOSITY (L) IS LOW ($L \propto M^{3.5}$) AND THEY ARE AT THE BOTTOM OF THE MAIN SEQUENCE (DIM AND COOL STARS):



THEY FORM SO-CALLED RED DWARFS: RED (LOW SURFACE TEMPERATURE) DWARFS ($L = 84\pi R^2 T^4$).

LIKELY, THE MAJORITY OF STARS IN

THE UNIVERSE ARE THE RED DWARFS,
BUT THEY ARE HARD TO OBSERVE
BECAUSE OF THEIR LOW LUMINOSITY:

$$B = \frac{L}{4\pi d^2}$$

LUMINOSITY = THE AMOUNT OF ENERGY EMITTED BY THE STAR PER UNIT TIME

BRIGHTNESS = THE AMOUNT OF ENERGY EMITTED BY THE STAR PER UNIT TIME PER UNIT AREA AT THE LOCATION OF THE OBSERVER

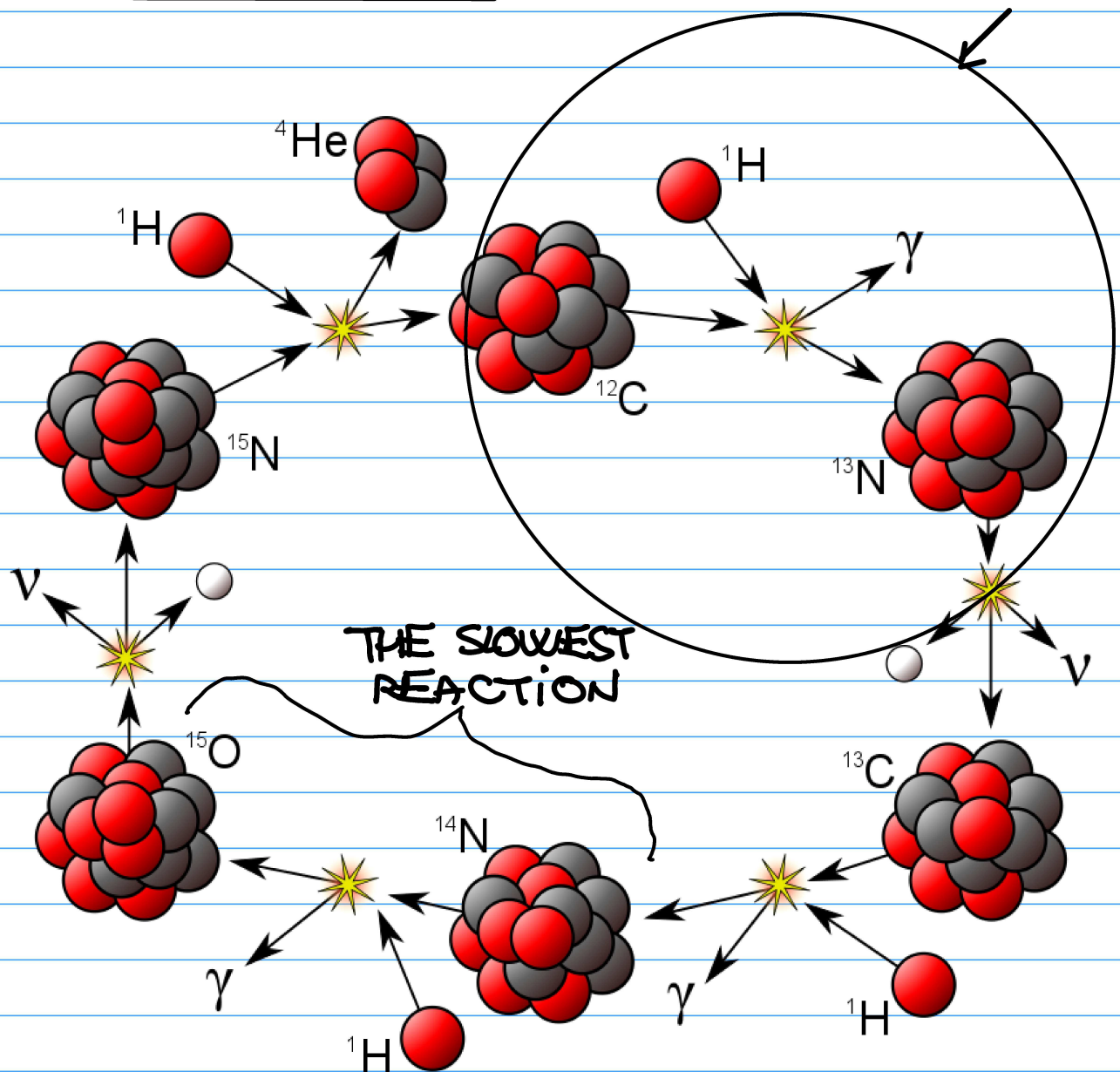
DISTANCE




PROXIMA CENTAURI (A MEMBER OF A TRIPLE STAR SYSTEM ALPHA-CENTAURI) IS A RED DWARF AND WE CANNOT OBSERVE IT WITH NAKED EYE IN SPITE OF THE FACT THAT IT IS THE CLOSEST STAR ($d = 4.24 \text{ ly}$).

MEDIUM MASS STARS: $0.5 M_{\odot} < M < 8 M_{\odot}$

STARS WITH MASS $< 2 M_{\odot}$ FUSE HYDROGEN INTO HELIUM VIA PROTON-PROTON CHAIN.

STARS WITH MASS $> 2M_{\odot}$ FUSE HYDROGEN VIA CNO-CYCLE:



	Proton	γ	Gamma Ray
	Neutron	ν	Neutrino
	Positron		

HIGH MASS STARS: $M > 8 M_{\odot}$

THIS STARS FUSE HYDROGEN INTO
HELIUM VIA THE CNO-CYCLE.