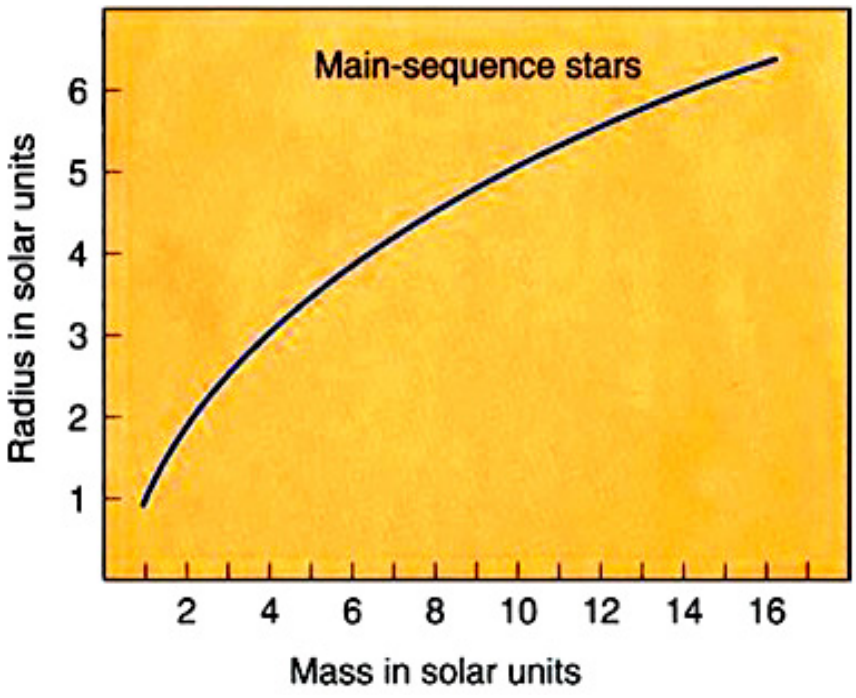
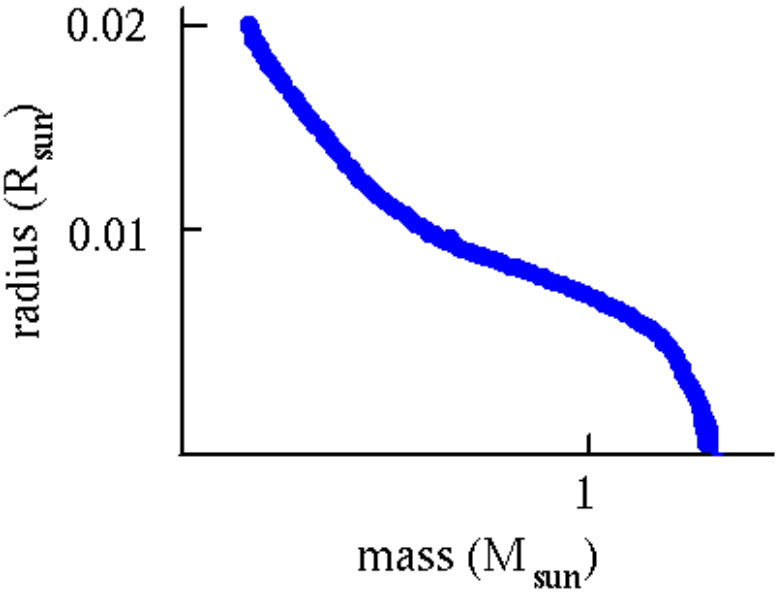
DEGENERATE MATTER HAS UNUSUAL PROPERTIES:

1) THE PRESSURE DOES NOT DEPEND ON TEMPERATURE (LIKE IN THE NORMAL MATTER/GAS) BUT ONLY ON DENSITY (IT INCREASES WITH DENSITY)
2) LARGER MASS HAS SMALLER RADIUS/SIZE.

NORMAL MATTER (E.G. A MAIN SEQUENCE STAR)



DEGENERATE MATTER (E.G. A WHITE DWARF)



CHANDRASEKHAR LIMIT: THE MAXIMUM MASS OF DEGENERATE OBJECT/BODY

FOR A WHITE DWARF IT IS $1.4 M_\odot$.

THE RANGE OF THE OBSERVED RADII IS:

$0.008 R_\odot$ — $0.02 R_\odot$

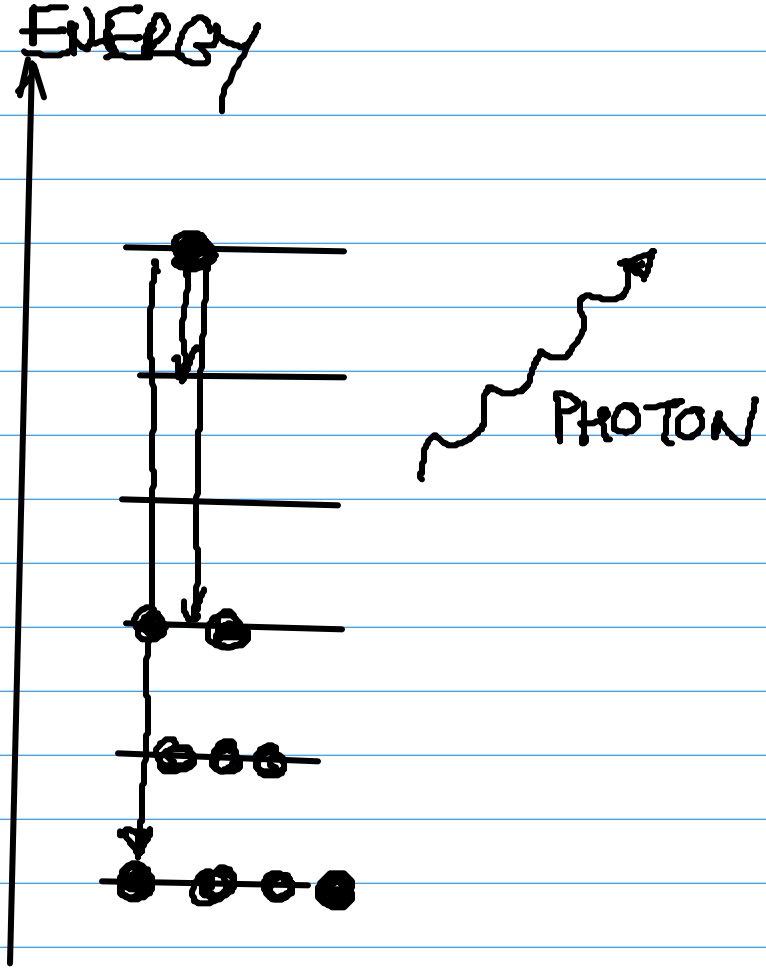
(THE RADIUS OF THE EARTH IS $0.009 R_\odot$)

THE RANGE OF THE OBSERVED MASSES IS:

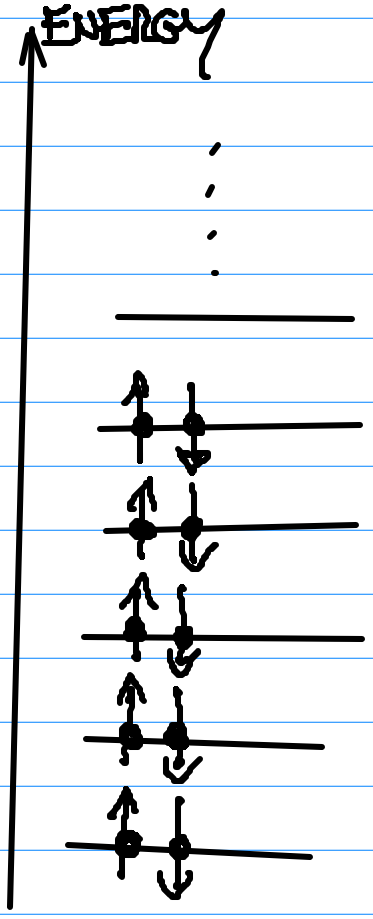
$0.17 M_\odot$ — $1.33 M_\odot$

MOST WHITE DWARFS HAVE MASSES FROM $0.5 M_\odot$ TO $0.7 M_\odot$

WHY ARE WHITE DWARFS PRODUCING LIGHT IF THEY DO NOT PRODUCE ENERGY VIA FUSION? CARBON AND OXYGEN NUCLEI DO NOT OBEY THE PAULI PRINCIPLE: THE NUMBER OF NUCLEI IN A GIVEN ENERGY LEVEL IS NOT LIMITED



DEGENERATE ELECTRONS:



ELECTRONS CANNOT DROP INTO THE LOWER ENERGY STATES BECAUSE OF THE PAULI PRINCIPLE.

EVENTUALLY ALL CARBON (AND OXYGEN) NUCLEI WILL DROP TO THE LOWEST ENERGY LEVEL AND THE EMISSION OF LIGHT WILL STOP. THE WHITE DWARF WILL BECOME A BLACK DWARF. THIS HAPPENS OVER VERY LONG PERIOD OF TIME, COMPARABLE TO THE AGE OF THE UNIVERSE.

WHITE DWARFS HAVE HIGH SURFACE TEMPERATURE OF SEVERAL TENS OF THOUSAND DEGREES. AS A RESULT THEY EMIT A LOT

OF HIGH ENERGY UV-PHOTONS. THESE PHOTONS EXCITE THE ELECTRONS IN THE ATOMS OF PLANETARY NEBULA INTO HIGHER ENERGY STATES. AS THEY DROP BACK INTO LOWER ENERGY STATES PHOTONS ARE EMITTED (FLUORESCENCE). THAT IS HOW PLANETARY NEBULAE PRODUCE LIGHT.