The Sun, a star with fairly average mass,
lies in the middle part of the main sequence,
with other yellow-white stars. the path on the diagram shows the typical life of a star like the Sun, from its collapse, and slow heating in a gas cloud, through its main sequence lifetime, and beyond that to the distant future, when it will eventually run out of fuel at its core, and swell to a red giant, slowly increasing its brightness as it does so.

********Useful facts and formulas**************

Radius of Earth = 6.4×10^6 m

Radius of Moon = 1.7×10^6 m

Radius of Sun = 7×10^{8} m

Mass of Earth = 6×10^{24} kg

Mass of Sun = 2×10^{30} kg

Mass of Moon = 7×10^{22} kg

Mean Radius of Mars' orbit = 1.5 AU

Temperature of Sun = 6000 K

Lifetime of Sun = 10^{10} years

1 day ~ 1×10^5 sec

1 month ~ 3×10^6 sec

1 year ~ 3×10^7 sec

1 Astronomical Unit = 1.5×10^{11} m

1 light year = 1×10^{16} m

1 parsec ~ 3 light years = 200,000 AU

1 Megaparsec (Mpc) = 10^6 pc

Radius of Moon's orbit around the Earth = 4×10^{8} m

Luminosity of Sun = 4 X 10^{26} Joules/sec

Newton's constant G = 2/3 X 10^{-10} m^3 s^{-2} kg^{-1}

Planck's constant h = 2/3 X 10^{-33} Joule sec

Speed of light c= 3 X 10^8 m/sec

1 Joule = 1 kilogram/meter^2/second^2 (a unit of energy)

Stephan-Boltzmann Constant sigma = 5.6 X 10^{-8} W/m^2/K^4.

Mass of proton ~ Mass of neutron ~ Mass of Hydrogen atom = 1/6 X 10^{-26} kg

0 degrees Centigrade corresponds to 273 kelvins

Hubble Constant ~ 70 km/s/Mpc

pi ~ 3

The angle subtended by an object in radians is given by its diameter, divided by its distance (the small-angle formula).

1 radian ~ 60 degrees ~ 200,000 arcsec. A full circle covers 360 degrees, or roughly 6 radians.

The circumference of a circle of radius r is 2 pi r; its area is pi r^2.

The surface area of a sphere of radius r is 4pi r^2; its volume is 4/3 pi r^3.

The acceleration required to keep an object in a circle of radius r at uniform speed v is a = v^2/r.

The gravitational force between two objects of mass M and m separated by a distance r is G M m/r^2.

Kepler's Third Law states that for orbits around a body of mass M, the period squared is proportional to the radius of the orbit cubed, divided by the mass M. If period is measured in years, the radius in AU, and the mass in solar masses, the constant of proportionality is unity.

The energy per unit time emitted by a blackbody of surface area A and temperature T is equal to sigma A T^4.

The wavelength lambda and frequency nu of a photon are related as lambda nu = c, where c is the speed of light. The energy of a photon is proportional to its frequency, E=h nu.

The blackbody spectrum of an object of temperature T peaks at a wavelength lambda = 2.9/T millimeter, if T is measured in Kelvin.

The luminosity of a main sequence star is proportional to its mass to the 3.5 power.

The brightness of a distant object is proportional to its luminosity times the inverse square of its distance to us.

The equilibrium temperature of a planet a distance d away from a star of surface temperature T_{star} and radius r_{star} is
T_{star} (r_{star}/2d)^{1/2}.

The Sun is 25,000 light years from the center of the Milky Way, and makes a full orbit once every 2.5 X 10^8 years. The mass of the Milky Way within the Sun's orbit is 10^{11} solar masses.

The parallax due to the Earth's orbit around the Sun, of a star 1 parsec away, is one arcsecond. Parallax is inversely proportional to distance.

The luminosity of a main sequence star is proportional to its mass to the 3.5 power.

The Doppler shift in the wavelength lambda of a light wave emitted from an object moving at speed v along the line of sight is Delta lambda/lambda = v/c. If the speed is close to the speed of light, one should use the more exact formula:
Delta lambda/lambda = ((1 + v/c)/(1 - v/c))^{1/2} - 1

Hubble's Law: The recession velocity of a galaxy is equal to its distance times the Hubble Constant H.

The age of the universe since the Big Bang is roughly the inverse of the Hubble Constant. This gives roughly 13 billion years.

The critical density of the universe is 3 H_0^2/8 pi G, or roughly 10^{-26}kg/m^3.

Time dilation: An observer moving by me at speed v will age

$\sqrt{1 - v^2/c^2}$ years, for every year I age, according to me. c is the speed of light. Lengths are contracted by the same factor.

Energy E and mass m are equivalent: $E = m c^2$.

The escape speed from the surface of an object of mass M and radius R is $(2GM/R)^{1/2}$.

The Schwarzschild radius of a black hole of mass M is $2 G M/c^2$. For one solar mass, this corresponds to a radius of 3 km.

In special relativity, the distance between two events in space-time is:

$$ds^2 = dx^2 + dy^2 + dz^2 - c^2dt^2.$$

The Planck time is $(h G/c^5)^{1/2} = 5 \times 10^{-44}$ sec.

The Einstein Field Equations of General Relativity are:

$$R_{\mu \nu} - 1/2\, g_{\mu \nu} R = 8 \pi T_{\mu \nu}$$

You need not understand the details of this, but the left-hand-side involves the curvature of spacetime, and the right-hand-side involves the mass, energy, and pressure at each point in space and time.

distance of Andromeda : 7.8×10^5 pc