Historical Introduction to our FusionPedia book…

While it is difficult to realize this as humans on the planet Earth, the universe is principally composed of matter in the state we call plasma which is defined as a high temperature gass where the electrons are largely separated from the positively charged nuclei of the atoms.

Plasmas are a gas of ions and electrons that forms the stars and gas between the stars in the galaxies that we see from the solid plane Earth when we look in the night sky or look directly at the Sun. The Sun is typical star that is a huge ball of very high temperature gasses…millions of degrees Fahrenheit or Centigrade that are far the universe. The planets around are Sun are the cool solid material that remained first in orbital rings after the early formation of the Sun and then collapsed into solid spheres as the gravitational forces in the rings brought the material into the spherical planets with the closest ring to the Sun forming the planet Mercury, then Venus, then Earth where the conditiohns where right for the origin of life, then Mars, the huge planet Jupiter, Saturn, …. continuing out to great distances to the edge of our solar system.

Only recently have we been able to send space craft Voyager I and Voyager II to the find the end of our solar system at some XXX kilometers from the Sun- a typical star. Between the stars is plasma at a lower temperature called the interstellar plasma. Vogager I and II are now send us data on the about the density and temperature of the interstellar plasma. Both were launched in 1983 and they crossed the interstellar boundary to in 2013 as described in Chapter X.

The plasma state of matter was discovered by Irving Langmuir while carrying out research at

General Electric in Schenectady New York in 1910. For his research on this fourth state of matter he received the Nobel Prize in 1932. One of the first topics you will study in plasma physics we call the Langmuir waves which led to his Nobel Prize. These are waves are the extension of the sound waves into the plasma where the electrons have escaped from the nucleus and the gas is now a plasma. The electrons still attracted to the ions but have too much energy to fall into the orbits of a gas. When the orbital dimensions greater than a certain size called the Debye length then we call the gas a plasma. Langmuir published and colleague Albert Hull this discovery their discovery in 1929. These Langmuir or plasma wave are a fundamental feature of the plasma machines we built to day in efforts to build a star now called the ITER machine which is a primary topic in the book. The ITER machine currently under construction in 8 [check number changes] international partnership to produce a electric power generator with the physics that drives the Sun. Originally, the name came from the initials form the International Thermonuclear Fusion Reactor but was later changed interpretation for the French ? word for meaning “the way” in about 2000. This reduces the public concern that arises from the word “thermonuclear“ which describes the bomb invented in the 1960ies first by Los Alamos Nuclear Laboratory and then by Soviet Union at Kurchatov Nuclear Laboratory. These bombs use the compression of hydrogen plasma by conventional explosives to produce the high temperatures to ignite the deuterium plus tritium plasma in an explosion.

That work was funded at Los Alamos by President Truman after the end of World War II and was in direct competition with similar secret research in the Soviet Union. The Soviet plasma physics were the first to produce the controlled laboratory burning hydrogen plasma machine called the Tokamak. The fusion plasma research was classified and top secret until declassified in Vienna in 19XX. Since the declassification the research has grown to widely through international collaboration.

Currently, there is large international project with partners including China,

Russia, Europe, the USA, India and xxx to build the first power producing tokamak called

ITER in the located in France. ITER is expected to be operational by 2015 and is expected to prove the feasibility of using the machine for design for future electric power generation.

In addition, China is designing a plan to build a similar larger machine to demonstrate the

Economic Feasibility of the Tokamak or ITER machine for commercial electric power production to compete with - or complement - the present use of nuclear fission power plants that are widely used today.

This book describes both the astrophysics and the international machine design physics of the

the thermonuclear plasmas. There is also a detailed description of the plasma spheres formed around the planets orbiting the sun and stars in Chapters X-Y. The solar orbital plasma physics is important for also for the Global Navigational Satellite Systems GNSS used for positioning and control of traffic, and other international issues.