CHAPTER V

CONCLUSION AND SUGGESTION
5.1 CONCLUSIONS AND OUTLOOKS

The thermonuclear processes, discussed in Chapter II, provides an interpretive framework for understanding the nature of neutron producing sources phenomena. Two major neutron producing reactions are $^{13}\text{C} (\alpha, n) ^{16}\text{O}$ and $^{22}\text{Ne} (\alpha, n) ^{25}\text{Mg}$ in the helium burning phase. The relative merit of these two reactions depends on the production of $^{13}\text{C}$ from $^{12}\text{C}$ and necessary of high temperature ($\sim 10^{9}\text{K}$) respectively. The production of $^{13}\text{C}$ is related to the mixing of hydrogen into the helium burning shell. This mixing of hydrogen from the outer envelope to the core leads to 1) Core helium flash i.e. ignition of helium under degenerate conditions ii) core instability. It is known from recent observation that core instability exists. Cowan et al (1982, 83) suggest that the core helium flash is, perhaps, more likely associated with an 'r' process (i.e. rapid neutron capture). But the actual site for this 'r' process has remained an unsolved puzzle. The neutron densities and temperatures characterise the 'r' process. Such conditions would most likely occur in an explosive environments such as supermassive stars (Seeger et al 1965), the neutronised core of exploding supernovae (Cameron et al 1970), hydrodynamic instabilities in rotating magnetised stellar cores (LeBlanc and Wilson 1970), shock induced exploding helium burning in
supernovae (Blake et al. 1981) are known but actual site and exact mechanism are still unknown. More investigation is needed for definite answer.

The energy generation in the helium burning triple alpha reaction is extremely temperature sensitive which leads to a burst of helium burning, and of neutrons from the $^{22}\text{Ne} (\alpha, n) ^{25}\text{Mg}$ reaction. Since the energy from this pulse is transported by convection, the sequential operation of thermal pulse followed by convective mixing to outer envelope of a neutron star is still unknown.

The thermonuclear flash may not occur simultaneously over the entire surface of the neutron star (Fryxell et al. 1982, Nozakura et al. 1984, Ruderman 1981, Taam 1985, 1991). The propagation time of the burning front in these cases around the star introduces a time delay in the energy production. Thus a detailed study of ignition, nuclear evolution, propagation of the burning front, during the thermonuclear runaway the energy transport by convection of neutron star would be highly desirable.

The formation of a superdense condensation of matter such as neutron star has discussed in Chapter III. In the domain of $\rho = 2 \times 10^{14}\text{g.cm}^{-3}$
there appears, along with the neutrons in equilibrium, a small number of protons and electrons, many other types of elementary particles. Though it is considered pure neutrons and neutrons are in equilibrium but still that small number of protons and electrons take part a significant role in increasing the number of neutrons and condition for equilibrium. A microphysical study is needed to answer the exact constituents at greater densities, condition for equilibrium, accurate mass of a stable neutron star.

A magnetic field of a neutron star may well have a strength of $10^{12}$ gauss at the surface. Observations on young radio pulsars such as Crab pulsar, Vela pulsar show the occurrence of glitches (sudden increases in the rotation rate). The identification of a 35d periodicity in the X-ray source Her-X1 argues many questions about large crust, effect of superconductivity and superfluidity on periodicity, Gamma ray burst, accretion in a neutron star. So, the detailed study of astrophysical behaviour of neutron star surface magnetic field may give answer to these unsolved problems.
REFERENCES


10. Taam, R.E. 1991 Private Communication