by Cook, Fowler, Lauritsen, and Lauritsen.[9] This process can be designated schematically by $3He^4 \rightleftharpoons C^{12*} \rightarrow C^{12}$ where C^{12*} is an excited state at 7.65 Mev in C^{12} which reaches an equilibrium concentration in the hot helium and from time to time emits gamma radiation or electron-positron pairs to the ground state of C^{12}. The overall result is the production of carbon from helium. In addition, the C^{12} can capture a free He^4 to form O^{16} which in turn can capture another He^4 to form Ne^{20}. On the basis of present estimates concerning reaction rates, C^{12}, O^{16}, and Ne^{20} will be produced in equal amounts within an order of magnitude by the time the He^4 is exhausted. This is in agreement with their observed cosmic abundances of $C^{12}:O^{16}:Ne^{20} \approx 1:6:2$.

On exhaustion of the helium, still higher central temperatures and densities result, and if the star remains stable and does not come to a catastrophic end at this stage, then the carbon, oxygen, and neon will begin to interact to form still heavier nuclei. The interaction consists mainly of exchange of He^4 nuclei or alpha particles and has been designated as the α-process by Burbidge, Burbidge, Fowler, and Hoyle.[4] Little is known concerning the rates of such interactions and this should prove a fruitful field of research for heavy ion accelerators now in operation. It can be estimated that the α-process occurs at temperatures near 2×10^9 degrees and densities near 10^6 grams/cm^3. From the standpoint of nuclear physics, it is clear that this sequence of successive burning of heavier and heavier nuclei will eventually terminate at the iron group nuclei which are the most "stable" nuclei in the sense that the internal neutron-proton energies are at a minimum and their binding energies are at a maximum in absolute magnitude. Both heavier and lighter nuclei have higher internal energy content and are less "stable" in this sense than the iron group nuclei. The shape of the iron group peak in the cosmic abundance curve is in good agreement (Burbidge, Burbidge, Fowler, and Hoyle)[4] with the expected equilibrium distribution at $\rho \sim 10^8$ grams/cm^3 and $T \sim 4 \times 10^9$ degrees. In Table I, the process is designated as the equilibrium or e-process.

The α-process and the e-process probably occur at a rapidly evolving or even explosive stage of stellar evolution. It has been suggested (Burbidge, Burbidge, Fowler, and Hoyle)[4] that the collapsing core of a star in its terminal stages as a red giant or in its final catastrophic supernova stage is a possible site for such processes. The collapse of the core is brought about by the fact that no further generation of nuclear energy occurs after the iron group nuclei are produced. Gravitational contraction takes place unimpeded. The explosion is actually speeded up in the inner regions of the core by the refrigerating action of nuclear processes which transfer the iron group nuclei back into lighter nuclei with the absorption of energy.

The implosion of the core removes the underlying support of the envelope material of the star which contains unevolved nuclear fuel capable of releasing large amounts of energy on being raised to high temperature. The gravitational collapse of the envelope material does just this. The energy release by the nuclear reactions in the envelope material further raises its temperature, the collapse is reversed by expansion of the material and all or part of the envelope material and probably even a portion of core material is blown out from the star at high velocity. The result is observed