have been made by a large number of authors to investigate the rotation of protostars or the collapse of the iron core of a highly evolved massive star. To date, most of these calculations have been performed assuming a simple adiabatic equation of state (P = \rho^\gamma) and a fixed zeroth order structure of these rotating objects. The final equilibrium configuration to which a given object will collapse on a dynamic time scale is shown to be predictable analytically. The final density, radius, and degree of flattening are uniquely determined given only the degree of importance of rotation and thermal energy in the initial object and given the adiabatic exponent \gamma that governs the collapse. The analytic predictions are compared to numerical results already available in the literature; in all cases quantitative agreement is good and in some cases even quantitative agreement is attained. Predictions of the model are outlined, stressing applications to both protostar and iron core collapses.

18.09 Neutron Star Evolutionary Sequences. M. B. Richardson, Univ. of Illinois -- Detailed cooling calculations of non-rotating, non-magnetic neutron star evolutionary sequences were made using a fully general relativistic, spherically symmetric, quasi-static stellar evolution code [Richardson, M. B., Van Horn, H. M., and Savedoff, M. P. (1979) Ap. J. Supplement Series, 39, 29]. Stellar models of 1.33 M⊙ and 0.503 M⊙ were constructed using a soft equation of state, with \rho f (0.8 and 0.10, respectively, Thermal effects, including crust crystallization, nucleon superfluidity, and neutrino emission from a postulated pion condensate, were incorporated in the calculations. Initially, the rate of heat loss from the core due to neutrino emission is much more rapid than the diffusion of heat through the crust; thus the early evolution is characterized by a non-isothermal interior with the core a factor of 10 cooler than the crust. The timescale for the 1.33 M⊙ star to become isothermal is \sim 1 year, it is \sim 30 years for the 0.503 M⊙ star, the difference due to the thicker crust on the 0.503 M⊙ star. The timescale for the effective temperature to reach \sim 2 \times 10^9 K is \sim 300 years for the 1.33 M⊙ star and \sim 150 years for the 0.503 M⊙ star. This research was supported in part under a NSF grant AST-79-09-391, while at the University of Rochester, the State University of New York at Albany where many of the calculations were performed, and by NASA grant NGR-7653 at the University of Illinois.

18.11 Stability of the g-Modes of a Super-Adiabatic Fluid in the Presence of Radiation Dissipation. J. Stan, U. PA. The g-modes in a convective layer (a super-adiabatic fluid) which in the absence of any dissipative mechanism are exponentially growing unstable modes, are discussed. The rate of energy loss per unit mass due to excess radiation of the moving element is introduced as a dissipative mechanism and its effect on the exponentially growing convective motion of a super-adiabatic fluid is analyzed. It is found that the dissipative mechanism reduces the growth rate of certain modes. Some unstable modes are eliminated and replaced by stable modes. Some modes which become neutral give rise to steady convective motions. However, the fluid will possess a group of unstable modes no matter how small the degree of superadiabaticity of the fluid or how strong the dissipative mechanism.

18.12 Evolution of a 0.28, with Zero Heavy Element Content. P. Demarque and D. B. Gruenberg, Yale Univ. Obs. -- An evolutionary track for a star of 0.28, with the chemical composition (X, Z) = (0.80, 0) has been calculated from the main sequence to the giant branch. We found it necessary to include the effects of helium burning at an early stage so as to keep track of trace amounts of carbon which would initiate CN burning. Although the path in the HR diagram was similar to that of a metal poor star, the internal structure of the models differed; in particular hydrogen was not depleted in the core. Models showed that the convective core, a result of CN burning, grew at a sufficient rate to increase the hydrogen abundance in the core. If allowed to continue, this process would eventually result in the mixing of hydrogen from the envelope into the center of the star and hence prevent further evolution up the giant branch.