

Nuclear Physics I: Nuclear Astrophysics

PHYS 8801

Alexander Heger¹

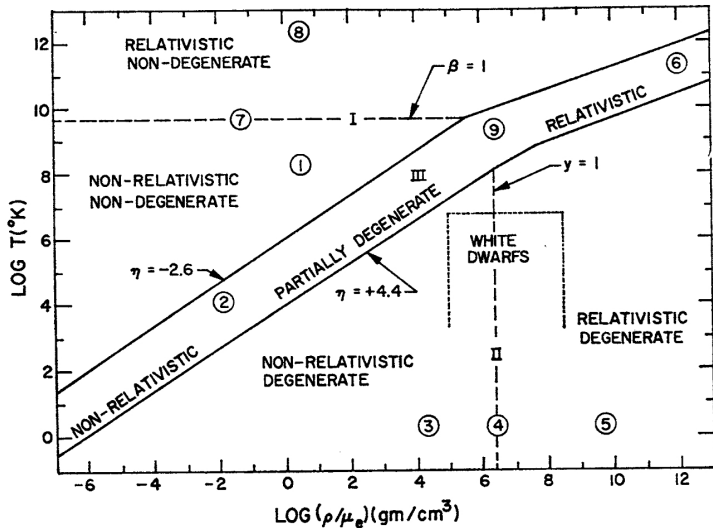
¹Minnesota Institute for Astrophysics
School of Physics and Astronomy
University of Minnesota

Nuclear Physics I: Nuclear Astrophysics, Spring 2012

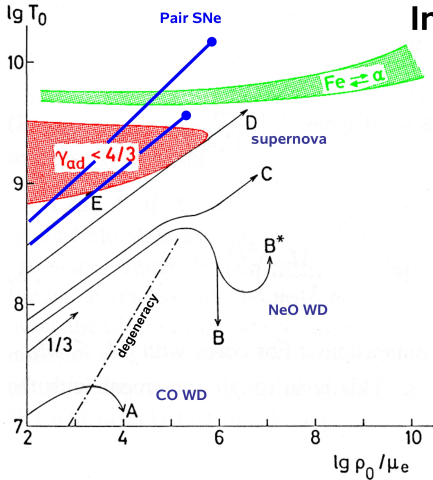
Agenda

- 1 EOS
 - Over/Review
 - Electron-Positron Pairs
 - Dissociation of Nuclei

Electron Equation of State Regimes



Electron-Positron Pair Production and Iron Dissociation



Instability Regimes

adiabatic index $< 4/3$

Compression does not result in sufficient increase in pressure (gradient) to balance higher gravity at lower radius

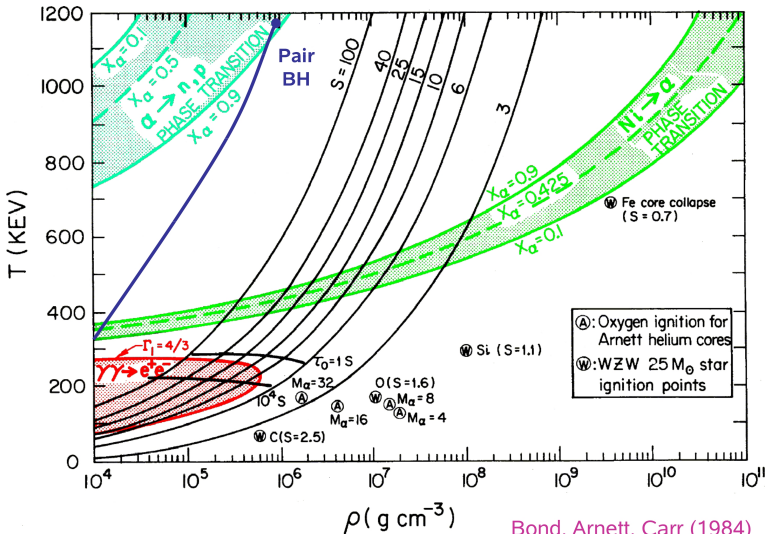
e^+/e^- -Pair Instability

Internal gas energy is converted into e^+/e^- rest mass (hard photons from tail of Planck spectrum)

Photo disintegration

Internal gas energy is used to unbind heavy nuclei into alpha particles and at higher temperature those into free nucleons

Helium and Iron Dissociation



Bond, Arnett, Carr (1984)