Influence of Pressure at Forming the Equilibrium Composition of Neutron Stars

N. Chamel[1], **R. L. Pavlov**[2], **L. M. Mihailov**[3],
Ch. J. Velchev[2], **Zh. K. Stoyanov**[1,2], **Y. D. Mutafchieva**[1,2],
M. D. Ivanovich[2]

[1]ULB, Institut d'Astronomie et d'Astrophysique BE, Boulevard du Triomphe CP226 B-1050 Bruxelles

[2]Institute for Nuclear Research and Nuclear Energy,
Bulgarian Academy of Sciences, 72 Tsarigradsko Chaussee,
1784 Sofia, Bulgaria

[3]Institute of Solid State Physics, Bulgarian Academy of Sciences,
72 Tsarigradsko Chaussee, 1784 Sofia, Bulgaria

In the present paper we study the effects of pressure below the neutron drip on the equation of state of a relativistic degenerate electron gas.

The studies were made when setting fixed values for the intense magnetic fields and for the zero-temperature case. We use the nuclear model BPS [1] for determine the equilibrium composition and equation of state as functions of the mater density. The BPS model consist a Coulomb lattice of heavy nuclei with a single nuclear species (A, Z) embedded in an electron gas. The total energy density $\epsilon(A, Z, n_e, n_n)$ is function of number densities of nuclei and electrons and of (A, Z).

At numerical procedure the equilibrium values of A, Z and pressure P are determined by minimizing the Gibbs free energy per nucleon

$$g = \frac{Z}{A} \frac{\epsilon + P}{n_e},$$

for different fixed values of P.

For every value of Z from 2 to 118 the calculations are done for different values for A. The study includes over 8000 nuclei. Conclusions are made for the distribution of neutron drip points and the number of corresponding electron densities.

References

[1] Baym, G., Pethick, C., and Sutherland, P.: *ApJ.*, **170** (1971) 299.