* ABSTRACT *

In this work, the equation of state (EOS), is applied in both nuclear and neutron matter. We are mainly concerned with the polarized nuclear and neutron matter. The EOS is derived using three types of potentials, namely, standard Seyler-Blanchard (SB), modified Seyler-Blanchard (SBM) and generalized Seyler-Blanchard (GSB) potentials. The calculations are performed in the framework of Thomas-Fermi (TF) model.

The applications of these three EOS's in both polarized nuclear and neutron matter are carried out at, zero and finite temperatures. Also we applied these EOS's on neutron star structure.

We found that the equation of state, derived with standard SB is a stiff EOS, while the equations of state derived with SBM and GSB potentials are soft EOS's. This is clear from a low effective mass and high incompressibility obtained with SB potential, compared with high effective mass and low incompressibility obtained with both SBM and GSB potentials. This is also confirmed from the behavior of the pressure with density.

The phase diagram for nuclear matter is also studied. We found that, in general, its shape is similar for all used potentials, but the critical

temperature is slightly different. We obtained a critical temperature in the range 17→18.5 Mev for all our EOS's.

The application of the equation of state on neutron matter gives the same trend as that for the nuclear matter, where SB potential gives a stiff EOS, while SBM and GSB potentials give a soft EOS.

Neutron star applications, also ensure the stiffness of our SB -EOS and softness of the two other EOS's. Where EOS with SBM and GSM potentials give maximum mass for stable neutron star around 2 Mo and the corresponding radius around 9.5 Km ,which is in good agreement with both experimental data and the other previous results. But SB potentials give higher values of the mass and radius.