study of the equation of dense matter suchas super novataking into account the nuclear fusion of light nuclel

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This thesis deals mainly with the study of fusion reaction crosssectionof some light and intermediate-mass nuclei and the equationof state of nuclear matter as well as of neutron matter. Also thestatistical properties of nuclear matter have been considered.First a theoretical investigation of fusion reaction cross-sectionshave been performed for many light and intermediate-mass nuclei. Todo this investigation we have used three types of potentials i.e. M3Y,DDM3Y and W-S interactions. Different approximation methodshave been taken into account in the calculation of fusion reactioncross-section. The analytical expressions for calculating the real partof the potential between two ions have been introduced into acomputer programme, which gives the required calculations with highaccuracies.Secondly we have developed Thomas-Fermi model to calculatedifferent thermal properties of nuclear and neutron matter at zerotemperature. We extended this calculations to finite Itemperature usingFermi integrals in its exact form and an expanded form up to T2-approximation. To calculate these properties we haw used the densitydependent modified three Yukawa (DDM3Y) interaction, which iscommonly used into collision processes , and we obtained its newparameters suitable for asymmetric nuclear matter. Such parametersare adjusted to reproduce the binding energies,densities and symmetryenergies of nuclear matter. Then we used these parameters to obtainother properties of nuclear and neutron matter. We show also theeffectof the neutron excess parameter on nuclear matter .We applied the effective n-n interaction ofDDM3Y to derive anexpression for pressure of nuclear matter as a function of the specifieddensity and temperature up to T4_approximation. We expanded thisexpression around the critical density and temperature (p, and Tc) toobtain the critical exponent of nuclear matter near the critical point ofthe phase transition. The density flactuations are evaluated byexpanding the Gibbs free energy near the critical point. The statisticalweight of nuclear system is used to investigate the statistical propertiesof the system.We used the derived stiff equation of state of neutron matter toanalyse the neutron star structure (mass and radius). We find that themaximum mass and maximum radius derived from our equation of stateare in a reasonable agreement with that derived from x-ray pulsar. Theeffect of temperature on mass and radius is very small and can beneglected.Generally good results have been abtained especially for nuclearmatter and its application.Concerning fusion we find that the results

abtained with M3Y andW-S interactions are better than those with the original DDM3Yinteraction, but this interaction, after readjusting its parameters to fit thenuclear matter properties,give better result for fusion C.S. calculations.