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A NEW MODEL FOR THE STRUCTURE AND EVOLUTION OF MAIN SEQUENCE STARS.

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ABSTRACT From both astronomical facts and theory it is inferred that the primary energy of main sequence stars most probably comes from gravitational work around a neutron star. The new mechanisms involved can in principle account for the observed facts, including those unconsistent with conventional models.

INTRODUCTION

It is well recognized that the densest states of matter in the universe are those of neutron stars (NSs) and black holes (BHs). The total gravitational (G) energy released from collapse of matter around a NS or a BH is about two orders of magnitude larger than that of nuclear fusion (NF) of the same mass of H. Then it is reasonable that the energy observed in the universe comes, primarily, from G collapse around NSs. Since most of this energy comes from main sequence stars (MSSs), this most probably occurs just inside of them. From the works of Vera (1981a,b, 1986) on gravity, it is also inferred that stars would normally be formed by condensation of gas around black remains from previous stellar evolution. Condensation around dead stars and NSs would rapidly regenerate new stars of high density, i.e., MSSs or blue stragglers. Condensation around planets and other bodies of similar densities would form voluminous red stars. The identification of these stars in HR diagrams of star clusters is simple.

THE NEW MAIN SEQUENCE STAR MODEL

In it, matter would collapse around a central NS. The high energy photons and plasma released in this region, similarly to the case of a drop of water over hot iron, would generate an interphase that would temporarily stop the collapse until the energy in excess is dispersed. Neutrons of elements heavier than H falling into the NS, would be preferentially captured by it, according to "nuclear stripping". The high energy protons

rejected by the NS can dissociate other heavy nuclei. This lower density material, with regenerated nuclear latent energy, would support convection currents transporting heat and nuclear latent energy to upper levels, where they can be liberated. this would keep high star density and superficial temperatures. Nuclear fusion of H would would generate neutrons that would be captured, later on, by the NS.
The high differential rotation around the NS would prevent non axial unsymmetries. The strong magnetic field generated by the rotation of the positively charged NS, would delay, preferentially, the non axial fall of electrons thus increasing, temporarily, the positive charges of the rotating core. This, turn, would increase the magnetic field and so on. These fields and the high energy photons and particles generated during collapse would react against it. Then the collapse pulses amplitudes would be somewhat larger about the polar regions. Thus this mechanism would be primary source of all of them: energy, magnetic fields, high energy particles and photons, convection currents and coherent pressure wavefronts. Through the time, the NS mass would increase at the cost of a decrease of that of its external envelope thus producing a slight temperature increase, i.e., becoming bluer. The amplitude of the pressure pulses travelling away from the core would normally be absorbed within the envelope thickness unless that some natural oscillation modes can be excited thus producing variable stars. Eventually, these pulses could trigger coherent thermonuclear explosions within the envelope. Depending on the masses, they could either eject rather spherical shells of gas (planetary nebulas) or feed back more powerful collapses, with more complete envelopes ejections thus leaving rather naked NSs that may also continue capturing matter in pulsed ways (pulsars).

Pre main sequence stages.
Old planets or similar bodies covered by new gas would become low density (rather giant) red stars with a central core of heavier elements. The gradient of atomic masses in these cores would prevent convection in them. Thus, stars would contract themselves similarly to conventional models, but with somewhat higher central densities. During this contraction, the endoenergetic nuclear reactions of heavy elements in the core below would absorb energy from gravitational contraction and NF of H. Sooner or later a macronuclei or NS is likely to start growing there. The increasing G energy released around the NS would initiate new convective currents that would speed up the transition from low density red stars up to bluer MSSs. This is consistent with the low number of stars observed in the HR diagram between red giants and MSSs. During these changes, pulsed collapses can also excite natural oscillation modes thus producing periodical variable stars.

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Main tests:
For reason of space, only a few ones can be mentioned here:
1.- The low neutrino luminosity of the Sun would. A NS of about 0.01Mo would account for it.
2.- The theoretical mass-luminosity, equal to the product of the average rate of neutron generation and the G energy yield per neutron, is proportional to $M^{3.67}$ in agreement with current literature.
3.- The main internal magnetic field would be produced through the above mechanism so that magnetic unsymmetries during sunspot cycles would come from axial oscillation of the NS relative to the envelope.
4.- The similitude of pulse shapes of supernovas and those observed in many stellar phenomena, like variable stars, pulsars, supernovas and X-ray burstars would come from the similitude of collapses under different conditions.
5.- The coherence of stellar surface oscillations and or pulsations are clearly consistent with central NSs. The symmetry of planetary nebulas also shows that some coherent thermonuclear explosion was triggered by a pressure wave coming from nearly point central source.
6.- The smaller Sun quadrupole moment, derived from difference between the theoretical and experimental values of the perihelium shift of mercury. This shows up the dominant effect of the rather spherical G field of the central NS.
7.- Narrow cosmic jets of high energy particles. They would be produced by the above mechanism occurring around BHs. The small cosmic ray peak with magnetic rigidity of 1.6 GV reported by Mc Donald (1959) would correspond to He fall (Vera 1981b).
8.- The blue progenitor of SN1987A would correspond, to the contrary of conventional models, to the latest stages of MSS evolution. Observe that this would come out from evolution of some red giant, after formation a NS which may grow up through more that one stellar cycle untill becoming a BH.

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