

# GR effect feedback at the surface of Neutron Stars

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A coherent description of General Relativistic effects results in a density feedback from the surface of the neutron stars, resulting in a causality description for the triggering of Supernovae and a well constrained energy release for the Gamma-ray Bursts between 2-4.5 solar mass equivalent energy release in the initial event.

# Einstein's famous equation

☒  $E=mc^2$  – connects the massive matter with the photons

☒ For a moving object with constant volume in a gravitational field it transfers into  $\rho c^2 = \text{const}$

☒ We know that  $c$  is changing near mass

☒ It results the density change of massive compact objects – neutron stars

# Coherent representation of GR

- ▣ Einstein called the ‘stress-energy’ side of his field equations “sand” – as compared to the left side ‘geometry’ as rock solid
- ▣ The gravitational red-shift, the Shapiro time delay and the light bending could be represented with one light propagation speed equation, representing a scalar

$$c(m, r) = c * \left( 1 - \frac{Gm}{c^2 r} \right)$$

# New descriptions of effects

▣ Gravitational red-shift =

Doppler analogy effect,  
describing the difference of  
local light propagation speed  
from the basic constant

$$z = \frac{Gm}{c^2 r}$$

▣ Gravitational ‘constant’

changes with the gravitational  
potential (Mercury)

$$G(m, r) = G_0 \left( 1 - \frac{Gm}{c^2 r} \right)^2$$

# New effects turned out to be GR

❏ The changing gravitational constant offers a different solution for the so called ‘non-baryonic cold dark matter’ – CDM – issue: there is no need for exotic speculations, the observed velocity distribution in galaxies is the same GR gravitational effect (mass feedback) as the Mercury perihelion precession!

# Density feedback – a new GR effect

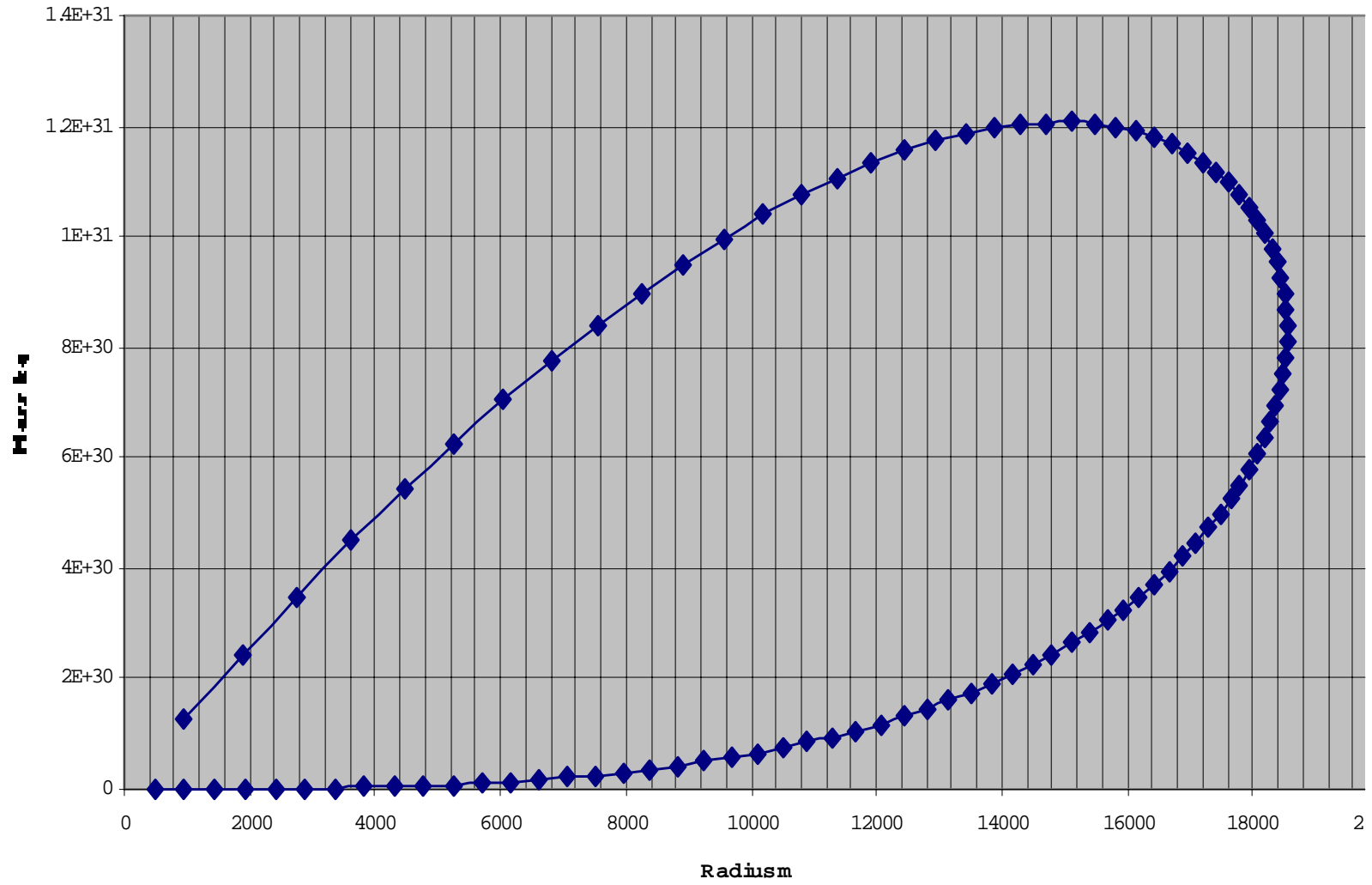
From the modified  $E=mc^2$  follows:

$$\rho(m, r) = \frac{\rho_0}{\left(1 - \frac{Gm}{c^2 r}\right)^2}$$

For the neutron stars or their progenitors the following mass-radius defining equation follows from the ‘density feedback’ GR effect:

$$m = \frac{4}{3} \pi r^3 \frac{\rho_n}{\left(1 - \frac{Gm}{c^2 r}\right)^2}$$

# Nuclear Mass and Radius



# Predictions from the graph

- ▣ Above 4.2 solar masses the increase of mass results in decrease of radius, which is a sign of instability
- ▣ Supernovae explosions are necessary to drop from the top part of graph to the lower, stable
- ▣ It will start with a GRB releasing energy equivalent to 2-4.5 solar masses
- ▣ The resulting Neutron Stars will have masses of 1-3 solar masses and radii of 14-18 km – well in agreement with observations

# References

- ❖ Return to colliding atoms Aladar Stolmar Poster 488 at IAU XXV General Assembly 218 Symposia also <http://stolmarphysics.com>
- ❖ Return to colliding atoms, Aladar Stolmar 2002 Physics Congress Proceedings FUNDAMENTAL PROBLEMS OF NATURAL SCIENCES AND ENGINEERING <http://www.physical-congress.spb.ru/2002en.asp>
- ❖ Super-heavy nuclei in the cores of stars and planets, Aladar Stolmar 2002 Physics Congress Proceedings FUNDAMENTAL PROBLEMS OF NATURAL SCIENCES AND ENGINEERING <http://www.physical-congress.spb.ru/2002en.asp>
- ❖ [The above describe the same from first principles, also for the real shape of nuclei and Neutron Stars]
- ❖ “with constant mass and increasing density one has the transition to a smaller radius” ... “Hence there is a limit to the concentration, above which a sphere of incompressible fluid can not exist” Communication by K. Schwarzschild to the Prussian Academy of Sciences, dealing with the gravitational field of a sphere of incompressible fluid. <http://arxiv.org/abs/physics/9912033>