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P3.037 Gravitationally confined relativistic neutrinos

C Vayenas^{1,2}, A Fokas^{3,4} and D Grigoriou¹

¹University of Patras, Greece, ²Division of Natural Sciences, Greece, ³University of Cambridge, UK, ⁴University of Southern California, USA

Combining special relativity, the equivalence principle and Newton's universal gravitational law with gravitational rather than rest masses, one computes that gravitational interactions between relativistic neutrinos with kinetic energies above 10 MeV are very strong and can lead to formation of gravitationally confined composite structures.

One may model the formation of such composite structures by considering three neutrinos moving symmetrically on a circular orbit under the influence of their gravitational attraction, and by assuming quantization of their angular momentum, as in the Bohr model of the H atom. The model contains no adjustable parameters and its solution leads to composite state radii close to 1 fm and neutrino velocities so close to c , that the corresponding Lorentz factor, γ , values are of the order of 5×10^9 . It is thus found that when the neutrino rest masses are of the order of $0.05 \text{ eV}/c^2$, then the mass, $3\gamma m_\nu$, of such three rotating neutrinos structures is very similar to that of hadrons ($\sim 1 \text{ GeV}/c^2$). The thermodynamics of the phase condensation of neutrinos to form such structures are compared with QCD calculations for the quark-gluon condensation temperature.

Using the same approach we find that the mass of relativistic rotating $\nu_e - e^\pm$ pairs is $81 \text{ GeV}/c^2$, close to that of W^\pm bosons.