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The inconsistency of a model for internal structure of black holes

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Abstract. The recent claim that a black hole can be treated as a relativistic gas of micro black holes (planckions) is shown to be physically inconsistent and in fact is grossly in error. Any deductions made about black holes from such models must therefore be treated with caution.

Keywords. Gravity; blackholes; relativistic gas; internal structure.

In a recent paper, Goswami and Sinha (1984) have claimed that a black hole (irrespective of its mass) can be treated as a superdense assembly of fermions, these fermions forming a relativistic gas of micro black holes identified as planckions, i.e. objects having a mass and radius equal to the Planck mass (M_p) and the Planck length (L_p) respectively. They further go on to claim that the equilibrium size of any black hole (mass M) is identified with its Schwarzschild radius ($2GM/c^2$) and can be obtained by balancing the relativistic degeneracy pressure of the Planckions with their gravitational attraction, for which they have used Newton's gravitational law.

All this clearly contradicts well-known and well-established results in black hole physics such as:

(i) once an object crosses its Schwarzschild radius, gravitational forces inevitably collapse the object to a singularity;
(ii) even in a few times the Schwarzschild radius Newtonian theory is a wholly inadequate description of the gravitational field of the object.

Even apart from this, their basic hypothesis of holding any black hole in equilibrium at its Schwarzschild radius by the relativistic degeneracy pressure of the so-called Planckions violates the well-known result in the theory of stellar structure that such a relativistic degenerate fermion gas cannot support a total mass greater than the corresponding Chandrasekhar mass against its gravitational collapse.

The authors do not arrive at this result for their equation (6) is wrong even in Newtonian fluid mechanics where the condition of equilibrium is given as: $\nabla_p = -\rho\nabla\phi$ ($\nabla\phi$ is the gravitational potential). Instead what they have is $\nabla_p = 0$.

The absurdity of considering a black hole as a system in equilibrium is also apparent from their equation (3) for the total number of planckions in a black hole. If applied for instance to a solar mass black hole of radius $\approx 2{\cdot}5$ km and volume $\approx 10^{16}$ cm^3 one would have a total mass in planckions of $10^{114} \times 10^{-5}$ ($N_p \times M_p$) g i.e. 10^{109} g, 76 orders of magnitude larger than the black hole mass of 10^{33} g!

So the possibility of picturing black holes as being supported at the Schwarzschild

radius by a dense fermion gas is ridiculous. Other seemingly important conclusions of the paper also thus stand invalidated.

References

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