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ERRATUM

Erratum to: Spherical collapse in vacuum $f(R)$ gravity

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We have found a serious problem in our paper (Banerjee and Chakrabarti 2014) on spherical collapse in $f(R)$ gravity. The calculations were based on the assumption that the Ricci scalar R is a constant. For the metric

$$ds^2 = dt^2 - X^2(r,t) - Y^2(r,t)\left(d\theta^2 + \sin^2\theta d\phi^2\right), \tag{1}$$

we obtained an exact vacuum solution for Y as

$$Y = A\sin^{\frac{2}{3}}\lambda(t_0 - t).y_2(r), \tag{2}$$

where A and λ are constants. This had been obtained under the separability condition

$$Y(r,t) = y_1(t)y_2(r). \tag{3}$$

The problem is that the resulting Ricci scalar, given by

$$R = -6\left(\frac{\ddot{y_1}}{y_1} + \frac{\dot{y_1}^2}{y^2}\right) = 4B^2\left[\cot^2 B(t-t_0) + 1\right] \tag{4}$$

is not actually a constant so there is a clear discrepancy. We note that up to the first integral in (18) of the paper (Banerjee and Chakrabarti 2014), there is actually no problem. One can find the first integral easily from (15) without assuming $Y(r,t)$ to be separable. The rest of the analysis is straightforward. It deserves mention that a very similar work by Kausar and Sharif (2011) suffers from the same inconsistency.

So we see that the problem, hitherto unnoticed, is rather generic. The only conclusion that can be drawn from both these works (Banerjee and Chakrabarti 2014; Kausar and Sharif 2011) is perhaps that a constant curvature collapse, if not a constant curvature exact solution as well, in an $f(R)$ gravity model is inconsistent and thereby untenable.

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References

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