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Black hole X-ray sources

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Irwin *et al*[1] recently reported on ultraluminous X-ray bursts in two ultracompact companions to nearby elliptical galaxies NGC 4697 and NGC 5128 (sources 1 and 2 respectively). Although they discuss a number of possibilities, they favour neutron stars and black holes as the likely sources: "*the sources appear to be normal accreting neutron-star or black-hole X-ray binaries*". However, there is no possibility for black holes to be associated with these X-ray sources because the mathematical theory of black holes contains a latent violation of the rules of pure mathematics.

The Authors have suggested that at least one of the black holes they have invoked is rotating. According to the mathematical theory there are four types of black hole: (a) charge neutral, non-rotating; (b) charged, non-rotating; (c) charge neutral, rotating; (d) charged, rotating. Since the theory of black holes is a mathematical theory it must comply with the rules of pure mathematics. That it does not do so renders it invalid. The ramifications of this fact are significant.

There exists an infinite equivalence class (i.e. an infinite set of equivalent solutions) for all theoretical black hole types. This equivalence class reduces to simpler forms according to the absence of charge ($q = 0$) or of rotation ($a = 0$), or of both ($q = a = 0$). The overall mathematical form is,

$$ds^2 = \frac{a^2\sin^2\theta - \Delta}{\rho^2}dt^2 - \frac{2a^2\sin^2\theta\left(R_c^2 + a^2 - \Delta\right)}{\rho^2}dt\,d\varphi +$$

$$+\frac{\left(R_c^2 + a^2\right)^2 - a^2\Delta\sin^2\theta}{\rho^2}\sin^2\theta\,d\varphi^2 + \frac{\rho^2}{\Delta}dR_c^2 + \rho^2 d\theta^2,$$

$$\Delta = R_c^2 - \alpha R_c + a^2 + q^2, \quad \rho^2 = R_c^2 + a^2\cos^2\theta, \quad R_c = \left(\left|r - r_0\right|^n + \xi^n\right)^{1/n},$$

$$\xi = \frac{\alpha + \sqrt{\alpha^2 - 4q^2 - 4a^2\cos^2\theta}}{2}, \quad a^2 + q^2 < \frac{\alpha^2}{4}, \quad r, r_0 \in \Re, \quad n \in \Re^+,$$

$$r = \sqrt{\left(x - x_0\right)^2 + \left(y - y_0\right)^2 + \left(z - z_0\right)^2} + \sqrt{x_0^2 + y_0^2 + z_0^2} = r' + r_0,$$

constituting all admissible 'transformations of coordinates'. This is a complicated set of mathematical expressions but the crucial issue is easily discerned. If any element of this infinite equivalence class cannot be extended to produce a black hole then none can be extended, owing to equivalence. The black hole requires that R_c be extended to $0 \le R_c$. To amplify, consider the case $r_0 = 0$, $n = 2$; then $R_c = \left(r^2 + \xi^2\right)^{1/2}$. Extension to produce a black hole therefore requires r^2 to take on negative values. However, r and ξ are real numbers and so neither r^2 nor ξ^2 can ever become negative. Thus, this particular case cannot be extended to produce a black hole. Hence no element of the infinite class can be extended, due to equivalence. Consequently it is impossible for black holes to be the sources of the X-ray bursts reported by the Authors.

REFERENCES

1. Irwin, J.A. *et al*., Ultraluminous X-ray bursts in two ultracompact companions to nearby elliptical galaxies. *Nature* **538**, 356–358, doi:10.1038/nature19822 (2016)

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