Testing The Area Quantisation Hypothesis From Black Hole Ringdown Signals

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The idea that the area of a black hole (BH) horizon is quantized goes back to Bekenstein and Mukhanov [1,2,3]. The area is conjectured to be a multiple of the Planck area, but the constant of proportionality α is unknown and depends on the specific theory of quantum gravity. Expanding on this idea, recent studies [4,5] suggested that thermodynamic relations applied to an astrophysical Kerr BH would lead to a "quantized" quasinormal mode (QNM) spectrum that depends explicitly on α. In particular, the central frequencies of the ringdown signal from a BH (a superposition of QNMs) deviate measurably from GR predictions. We propose a method based on Bayesian inference designed to infer the properties of the remnant BHs from a time domain analysis of the ringdown part of the gravitational wave signal. We try to infer α from GW150914 and find that it is not yet measurable. From a population of simulated events observed by second generation instruments at design sensitivity, we investigate the measurability of α and assess potential stealth biases caused by ignoring the BH area quantisation in ringdown analyses.

References:
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