

Future detectors can be used as gravitational microscopes to probe the horizon structure of merging black holes with gravitational waves. But, can this microscope probe the quantum regime? In this talk, I will discuss this question and show that (i) the error in the distance resolution is exponentially sensitive to errors in the Love number, (ii) the uncertainty principle of quantum gravity forces a fundamental resolution limit, and (iii) conclusions about the structure of spacetime at small distances rely on assumptions about the properties of the (unknown) compact objects considered, which is unstable to gravitational collapse due to accretion.