BLACK HOLES IN DENSE STAR CLUSTERS
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TITLE: A 400 Solar Mass Black Hole Associated with a Dense Star Cluster

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M82's brightest X-ray source has been thought to be an intermediate-mass black hole (100-10000 solar masses) because of its extremely high X-ray luminosity and variability characteristics, although some models suggest that its mass may be only of the order of 20 solar masses. The previous mass estimates were based on scaling relations which used X-ray low-frequency characteristic timescales which have large intrinsic uncertainties. In stellar-mass black holes, we know that the high frequency quasi-periodic oscillations that occur in a 3:2 frequency ratio (100-450 Hz) are stable and scale inversely with black hole mass with a reasonably small dispersion. The discovery of such stable oscillations thus potentially offers an alternative and less ambiguous mass determination for intermediate-mass black holes, but has hitherto not been realized. I will discuss the discovery of stable, twin-peak (3:2 frequency ratio) X-ray oscillations from M82 X-1 at the frequencies of 3.32 Hz and 5.07 Hz and how this helps overcome the systematic uncertainties present in previous studies. Assuming we can extend the stellar-mass relationship, we estimate its black hole mass to be 428+-105 solar masses. I will also discuss the plausible origin of such a massive black hole in a nearby dense star cluster.