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Supermassive Black Hole Demographics In The Era Of Multimessenger Pulsar Timing Array Detection

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Supermassive black holes lurk at the centers of massive galaxies, and are themselves the most massive compact objects in the Universe. Over cosmic time, galaxies grow through accretion and mergers, such that in the post-merger phase they harbor two supermassive black holes that spiral toward coalescence through a variety of dynamical processes. The subset of these with 108 - 1010 solar masses and orbital periods of several years form the target population for pulsar- timing array (PTA) experiments such as the North American Nanohertz Observatory for Gravitational Waves (NANOGrav) and the International Pulsar Timing Array (IPTA). PTAs search for nanohertz gravitational-wave signals through induced Doppler shifts to the arrival rate of radio-pulses from millisecond pulsars. Many candidate binaries have been found through traditional electromagnetic means, although the only system with confidently detected multiple radio cores is too widely separated for PTAs to detect. Likewise, the quasi-variability of AGN in various photometric surveys (e.g. CRTS, PTF, and PanSTARRS) has produced many candidates, but none whose variability is unambiguously tied to the presence of a binary. I will review current efforts to find binary supermassive black holes through PTA searches and targeted multi- messenger campaigns, then discuss what current constraints and future detections can unveil about massive black hole demographics and the growth of galaxies.