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Electromagnetic Emission from Supermassive Black Hole Binaries Resolved by Pulsar Timing Arrays

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Pulsar timing arrays (PTAs) are expected to detect gravitational waves (GWs) from individual low–redshift ($z < 1.5$) compact supermassive ($M > 10^9 M_\odot$) black hole binaries with orbital periods of $\sim 0.1 - 10$ yrs. I will discuss the feasibility of identifying the electromagnetic counterparts of these sources. Because the host galaxies of resolved PTA sources are expected to be exceptionally massive and rare, it should be possible to find unique hosts of resolved sources out to redshift $z \approx 0.2$. At higher redshifts, the PTA error boxes are larger, and may contain as many as ≈ 100 massive-galaxy interlopers, but the true counterpart may be identified from its peculiar spectrum and from its quasi-periodic variability. In particular, the binary's tidal torques expel the gas from the inner part of the circumbinary accretion disk, making the source appear unusually dim in soft X-rays, with unusually weak UV and broad optical emission lines. Additionally, if the orbital plane lies close to the line of sight, the UV lines would exhibit periodic Doppler shifts. These properties would make the PTA sources stand out among other optically luminous AGN.

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