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Variability in Circumbinary Disks Following Massive Black Hole Mergers NATHANIEL BODE, STERL PHINNEY, Caltech — When two super-massive black holes merge, a significant fraction of their total initial mass-energy is lost in gravitational waves. From the point of view of a circumbinary gaseous disk, much of this mass loss is effectively instantaneous, occurring on less than an orbital period. In a collisionless disk, we show that this leads to the immediate excitation of substantial epicyclic motion, and subsequent orbit-crossing. In a real gas disk, it leads to the excitation of acoustic waves and shock fronts, and consequent characteristic electromagnetic variability of the circumbinary disk around the newly merged black hole. We describe the dynamics and the variability, and show that the variations in disks around super-massive black hole binaries whose mergers will be observed by the Laser Interferometer Space Antenna (LISA) can be detected and used to provide unique insights into accretion disks -e.g. maps of temperature, disk thickness, and thermal timescale versus radius.

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