

# Physics Colloquium

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Monday, February 3, 2020 / Pupin Hall Theory Center, 8<sup>th</sup> Floor / 12:30 PM

*Lunch will be available for attendees*

## "The Gravitational and Electromagnetic Chirp of Supermassive Black Hole Binaries"

**Zoltan Haiman, Columbia University**



Supermassive black hole (SMBH) binaries are the primary targets of low-frequency gravitational wave (GW) experiments from space and from the ground. They are expected to be produced during collisions between galaxies carrying their own nuclear SMBHs.

I will argue that compact, gravitationally bound SMBH binaries should often be surrounded by plasma and produce bright electromagnetic (EM) emission. Hydrodynamical simulations of BH binaries with circumbinary accretion disks have revealed that the BHs can be fueled efficiently, with the fueling rates quasi-periodically modulated all the way to the BH merger. The corresponding EM emission is time-variable, with a periodicity pattern depending on the mass ratio of the BHs, and will contain unique spectral signatures. A post-merger afterglow is also expected, following the burst of GWs which drive shocks through the circumbinary plasma.

These effects may be used to identify unique EM counterparts of the GW sources expected to be discovered by Pulsar Timing Arrays (PTAs) and by the space interferometer LISA, and to discover wider binary SMBHs in time-domain EM surveys. The simultaneous EM and GW detections of SMBH binaries will enable a range of new science, from accretion physics to novel tests of gravity and dark energy.