

Manuel Arca Sedda
(Astronomisches Rechen Institute, ZAH - Heidelberg Univ.)

Title: Birth, life and death of black hole binaries in Galactic Nuclei

Abstract: In this talk, we will discuss the processes that regulate the formation of black hole binaries (BHBs) in galactic nuclei harbouring a supermassive black hole (SMBH). Using numerical simulations and analytical arguments, we show that two main processes contribute to the reservoir of BHBs in a galactic nucleus, namely in-situ formation and via delivery operated by massive star clusters that spiral inward due to dynamical friction. While approaching the galactic centre, the SMBH tidal field becomes dominant in determining the BHB overall evolution. Using N-body simulations that include Post-Newtonian dynamics up to 2.5 order, we study the long term evolution of BHBs orbiting an SMBH, showing that the onset of Kozai-Lidov oscillations can significantly reduce their coalescence time-scale. Our results suggest that this mechanism can trigger up to 1-20 merging events per yr and Gpc^3 , triggering the formation of BHs with masses within 50-150 M_{sun} , a mass range called “BH mass gap” since BHs with such masses are not expected by ordinary single and binary stellar evolution. We show that all the mergers in our models would appear circular in the LIGO band, whereas a fraction of them have the potential to be eccentric when transiting the LISA and DECIGO observational bands.