Understanding Tidal Disruption Events with gravitational waves (Martina Toscani, postdoc @ L2IT)

Tidal disruption events (TDEs) take place when a star in orbit around a massive black hole (BH) is torn a part by BH tides. After this violent rupture, bright electromagnetic flares are produced, at the same time as stellar debris is accreting onto the central object. To present, we have detected TDEs in optical, X-ray and radio.
Yet, during the event, there is also production of gravitational waves (GWs), in particular of a strong monochromatic burst during the disruption phase. The typical frequency of this signal is between milli-Hz and deci-Hz, right where future space-based GW detectors will operate, like LISA and possibly other observatories such as DECIGO and TianQin. Hence, in the upcoming future, we expect to see the disruption itself for the first time through gravitational emission, followed by EM production from the later stages of the event.
With this talk, I would like to explore what kind of information we can extract from these events thanks to GWs. I will start describing what is the impact that different orbital and physical parameters of the event have on the gravitational signal (Toscani et al. 2022). Then, I will illustrate which are the characteristics of the TDE gravitational background and what we can learn from its eventual detection (Toscani et al. 2020). Finally, I will conclude showing the first results of a new study aimed to investigate the effect of gravitational lensing on the GW signal from TDEs.