Gravitational wave from a stellar mass and an intermediate mass black hole binary surrounded by a dark matter mini-spike

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An intermediate mass black hole (IMBH) may have a dark matter (DM) mini-halo around it and develop a spiky structure within less than a parsec from the IMBH \cite{1, 2}. When a stellar mass object is captured by the mini-halo, it eventually infalls into such an IMBH due to gravitational wave back reaction which in turn could be observed directly by future space-borne gravitational wave experiments such as eLISA/NGO \cite{3}. In our work, we show that the GW detectability strongly depends on the radial profile of the DM distribution \cite{4}. So if the GW is detected, the power index, that is, the DM density distribution would be determined very accurately. The DM density distribution obtained would make it clear how the IMBH has evolved from a seed BH and whether the IMBH has experienced major mergers in the past.

\cite{1} P. Gondolo and J. Silk, Phys. Rev. Lett. 83, 1719 (1999)
\cite{3} P. Amaro-Seoane \textit{et al.}, arXiv:1201.3621 [astro-ph.CO]