

Title:

"First black holes: growth and observability"

Abstract:

The first black holes likely formed when the age of the Universe was less than 500 Myr and played an important role in the growth of early ($z=7$) supermassive black holes (SMBHs), weighing billions of solar masses.

In this talk, I provide a general introduction to the cosmological problem of the first black holes formed in the Universe and I present some insights to advance our knowledge of this topic.

First, how do we identify the first black holes in deep, multi-wavelength surveys? The observational signatures of black hole seeds remain largely unexplored, and as a result we are yet to detect these sources. I present a photometric method to identify black hole seed candidates in multi-wavelength surveys. The method relies on infrared and X-ray observations and selects the only two objects with a robust X-ray detection found in the CANDELS/GOODS-S survey with a photometric redshift $z>6$. To date, these selected objects represent the most promising black hole seed candidates, possibly formed via the direct collapse black hole scenario. Additional gains are expected from deeper spectroscopic and X-ray data. For this reason, I will explore the role that new facilities, like JWST and further in the future ATHENA and Lynx, will play in the detection of the first black holes in the Universe.

Second, how do we explain the presence of the first SMBHs by redshift 7? I present a probabilistic model for black hole growth, with important implications for the conditions that facilitate efficient growth at high- z . By bringing in a precise definition of "growth probability", the model clearly demonstrates quantitatively the generally-accepted concept that the $z=7$ SMBHs are the "luckiest" members of the ensemble of high- z black holes. Our formalism has significant and broad consequences for upcoming observations of high- z quasars, suggesting the presence of an additional, yet not investigated, population of undetected quasars.

Short Bio: Fabio Pacucci is a postdoc at Yale, working on theoretical aspects of the formation, cosmological evolution and observational properties of the first black holes formed in the Universe. He received his Ph.D. at the SNS in Pisa in 2016 and he is the IAU Ph.D. prize winner for the current year.