

Data Science at the Edge of the Universe: Using Quasars to kickstart the new field of Extragalactic Time-Domain Astrophysics

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Duration: 60 months

Black holes are intriguing objects. These regions of the Universe where mass is so dense, and gravity so strong, that even light cannot escape, were once thought mere oddities due to their extreme properties. Today, however, black holes are now thought to be vital in the formation and lives of galaxies, including our own Milky Way. Why are there a billion solar mass black holes at the centres of large galaxies? How did they form and how do they grow? Do they have any influence on the galaxy itself? And, are the fate of the galaxy and black hole intertwined? These are the key questions in contemporary astrophysics and the issues this research project will answer.

Data science, is a new interdisciplinary field of scientific methods and computational techniques that extracts knowledge and insights from data in various forms and often large volumes. It employs methods and theories drawn from many fields including mathematics, statistics, and computer science, in particular from the subdomains of machine learning, classification, databases, and visualization. As such, modern observational astrophysics must be considered a ``data science”.

Here we propose to kickstart the new field of Extragalactic Time-Domain Astrophysics by building on the P.I.’s data science experience and by using novel observational techniques to study accreting black holes in the early Universe. We will do this by utilizing and combining the firehose of data from several new large surveys that start to come online from late 2019 onwards. The unique aspect of this proposal is to breakdown the data silos of these new surveys. In doing so, we will learn about one of the two fundamental energy sources available to galaxies (accretion onto the central supermassive black hole) and perform the observational tests to gather the evidence to distinguish between galaxy evolution models and theory. We will also be best positioned to discover totally new extragalactic phenomena.