Extreme astrophysics through the lens of next generation of astronomical telescopes

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Over the past decade large-scale astronomical surveys of the cosmos have grown rapidly, and the next generation of observatories and surveys are already in development and/or underway. One of these, the Vera C. Rubin Observatory's Legacy Survey of Space and Time (LSST) will provide a massive data-set that provides insights into the nature of exotic astrophysical phenomena such as black holes, neutron stars and more. When Rubin/LSST comes online (currently scheduled for March 2025), it will scan the entire southern sky almost daily. Thus, it will provide us with a large, rich dataset to extract information on rare astrophysical events from the over 60 petabytes of data that will be collected over the next ten years. This PhD project will focus on one of the most pressing questions in modern astrophysics; namely how to delve through large data-sets to perform time-domain studies of astrophysical events.

Rubin Observatory will observe a large number of time domain optical events, such as black holes and neutron stars going into outburst, as well as luminous red novae. While Rubin is not currently online, a number of existing observatories such as the Zwicky Transient Facility (ZTF) and and the All Sky Automated Survey for SuperNovae (ASAS-SN) have been collecting data for the last few years. This project aims to mine publicly-available data from these observatories for signatures of black holes using state-of- the-art classification techniques. This will enable us both to better understand stellar remnants such as black holes, neutron stars, and white dwarfs, and to prepare us to leverage the upcoming generation of astronomical facilities such as the Vera Rubin Observatory to gain new insights into the population of these objects in our Galaxy.

Rubin Observatory will produce the deepest ever image of the entire southern sky.