**STFC funded PhD Project**

**Reference:** STFC-Watson

**Supervisors:**

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**Project Title:**  The AGN - galaxy connection: utilising the power of large sky surveys

**Project Description**

Supermassive black holes are now thought to lurk at the centres of most, if not all, galaxies but it is still unclear how these black holes form and what drives their subsequent growth over the history of the Universe. This project will focus on identifying growing black holes - seen as Active Galactic Nuclei (AGN; objects such as quasars and Seyferts) - and connecting the properties

of these AGN with the properties of the galaxies they lie in.

You will use the latest galaxy surveys, incorporating data from a wide range of facilities such as the Sloan Digital Sky Survey (SDSS) and the upcoming Legacy Survey of Space and Time (LSST) project to identify galaxies at different cosmic epochs and in different evolutionary states. You will then use

multiwavelength datasets including X-ray survey data from ESA's XMM-Newton observatory and NASA's SWIFT and Chandra satellites, together with optical spectroscopy, infrared imaging and radio data, to identify AGN within these galaxies and determine their properties (such as their uminosities, black hole accretion rates, and their level of obscuration). You will track how the levels of AGN activity depend on the galaxy properties (such as mass, morphology and star formation history) to provide new insights into the processes fuelling and regulating black hole growth across the evolving galaxy population.

On this project you will have the opportunity to work with three scientists: Prof. Mike Watson and Dr. Rhaana Starling, who have a wealth of experience in AGN surveys and related research and Dr. Keir Birchall who has just completed his PhD. with a thesis focused on studying AGN source populations, characterising their properties in the nearby Universe. The first supervisor, Prof Watson, is a senior UK astronomer who led the international team that created the XMM-Newton catalogues that will be one of the key elements of this project. Prof. Watson also has strong links with the LSST optical survey project.

Outside of Leicester, opportunities will exist for collaboration with a wide range of researchers at other institutes world-wide who are working in this field.

This project is data-intensive and will require advanced analysis techniques. Some familiarity with large astronomical datasets and programming in Python will be an advantage, but full training will be available in these areas and the supervisory team will be on hand to support you as you learn.

**References**

* **SDSS: https://classic.sdss.org/ & SDSS value-added catalogs:** [**https://www.sdss.org/dr14/data\_access/value-added-catalogs/**](https://www.sdss.org/dr14/data_access/value-added-catalogs/)
* **The LSST project (now renamed the Rubin Observatory):** [**https://www.lsst.org/**](https://www.lsst.org/)
* **The XMM X-ray Observatory:** [**https://sci.esa.int/web/xmm-newton**](https://sci.esa.int/web/xmm-newton)
* **SWIFT satellite:** [**https://www.swift.ac.uk/**](https://www.swift.ac.uk/)
* **Example research paper:** [**https://arxiv.org/abs/2001.03135**](https://arxiv.org/abs/2001.03135)