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# Constraining the Physics of Irradiated Accretion Discs in Black Hole X-ray Binaries

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## Abstract

There are ~18 known black hole low-mass X-ray binaries (BH-LMXBs), identified through bright outbursts that indicate rapid accretion episodes in our Galaxy.

The majority of optical/IR/UV light emitted by the accretion discs in these systems comes from the reprocessing of X-rays illuminating the disc surface. Comparing the disc stability criterion predicted by theoretical models with observations provides clear evidence that these BH-LMXBs discs must be irradiated. While we know that this irradiation alters the stability properties of these discs, how these discs are irradiated still remains largely unknown. Thus, to understand the outburst mechanism in these irradiated discs, we have developed a novel Bayesian hierarchical irradiated disc model. Using prior knowledge of binary orbital parameters, in combination with observed X-ray, optical, IR, and UV outburst light curves, we can constrain (i) key disc properties, such as viscosity, and (ii) properties of the X-ray irradiation affecting the discs, in X-ray binary systems. Here we will discuss the results of applying our model to the Galactic BH-LMXB population, and how these results help further our understanding of both the effect of X-ray irradiation on the discs present in BH-LMXBs, and the mechanism behind outbursts.

**Keywords:** accretion, accretion discs, black holes, X-ray binaries

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