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Black Holes (BHs) are one of the most interesting and extreme objects in astrophysics. Stellar mass BHs are born through the death of massive stars, and they cause various high-energy phenomena. Recently, the gravitational wave observations showed that massive ($\sim 30\ M_\odot$) binary BHs merge within the Hubble time and suggest there are 10^5 of rapidly rotating remnant BHs in our Galaxy. The stellar formation and evolution theories have predicted the number of Galactic BHs as $\sim 10^8$. On the other hand, only 60 BHs and BH candidates have been discovered by X-ray observations. This difference suggests that we miss a lot of BHs residing in our Galaxy. By detecting the missing BHs, we can test the stellar formation theory and investigate the accretion physics through detailed observations. Therefore, it is important to evaluate how many missing BHs can be detected by the future surveys.

In this thesis, we discuss the detectability of the Galactic missing BHs. We mainly focus on isolated (single) BHs and their X-ray signatures. We calculate the mass accretion distribution of isolated BHs taking the statistical properties, such as the BH mass and velocity distributions, into account. We find that as shown by previous works, isolated BHs in molecular clouds have the largest accretion rate. By using this distribution, we evaluate the detectability of isolated BHs assuming that they are stationary X-ray sources and that they cause transient events.

First, we consider the case where isolated BHs are stationary X-ray sources, and study their X-ray flux distribution. We calculate X-ray luminosity from BH mass accretion rate with less assumptions and uncertainties than the past works which gave overestimations of detectable BHs. Therefore, our results are one of the most conservative and robustest calculations. We find that the number of detectable BHs is less than ten even by the future X-ray satellite *eROSITA*. However, in the most pessimistic case, we require X-ray detectors with sensitivity of $f_X \sim 10^{-14}\,\mathrm{erg\ s^{-1}\ cm^{-2}}$ to discover an isolated BH. We also discuss how to tell isolated BHs from other X-ray contaminations. The future hard X-ray satellite *FORCE* will be useful to discriminate missing BHs from other sources by using hardness ratios. We apply our calculation procedure to the primordial BHs, which are one of the possible dark matter candidates. By comparing the predicted luminosity function with the current observation, we find that the current X-ray observation constrains the abundance of primordial BHs within a small mass range of $\sim 10^8\,\mathrm{M_\odot}$. A null detection of isolated BHs by *eROSITA* will impose more stringent constraints on the primordial BHs' abundance.

Second, we discuss the possibility that isolated BHs launch X-ray transients like X-ray novae, which are considered to be produced by BHs in binary systems. We study the structure of accretion disks of isolated BHs, and find that the isolated BHs in molecular clouds satisfy the condition of the hydrogen-ionization disk instability, which results in X- ray novae. The estimated event rate is consistent with the observed one. We also check an X-ray novae catalog and find that $16/59 \sim 0.27$ of the observed X-ray novae are potentially powered by isolated BHs. The possible candidates include *IGR J17454-2919*, *XTE J1908- 094*, and *SAX J1711.6-3808*. Near infrared photometric and spectroscopic follow-ups can exclude companion stars to confirm our hypothesis.