X-ray Verification of a Low-Mass AGN Powered by a Black Hole in the Thousand Solar Mass Range

Erika Gwin[1], Richard M. Plotkin[1], Roberto Soria[2], Aarran Shaw[3]

[1]University of Nevada, Reno
email: [egwin; rplotkin]@unr.edu
[2]Italian National Institute for Astrophysics (INAF)
email: roberto.soria@inaf.it
[3]Butler University
email: awshaw@butler.edu

Following their confirmation in the early 1970s, black holes have since been categorized into three main regimes according to their mass: supermassive black holes (SMBHs: $10^6 - 10^{10}\ M_\odot$), intermediate-mass black holes (IMBHs: $10^2 - 10^6\ M_\odot$), and stellar-mass black holes ($3 - 100\ M_\odot$). In order to reach the supermassive regime, black holes in galactic centers must have started off with smaller masses, growing through the accumulation of material through the processes of accretion and/or mergers. Currently, a multitude of black hole candidates in the $10^4 - 10^6\ M_\odot$ range have been identified; however, we still lack significant numbers of IMBH candidates of lower masses ($<10^4\ M_\odot$). New XMM-Newton X-Ray Observatory observations of a central X-ray source in a nearby spiral galaxy (stellar mass $\sim 10^{10}\ M_\odot$) reveal evidence of a potential $10^3 - 10^4\ M_\odot$ IMBH. Characteristic data, such as a soft, thermal X-ray spectrum, an inner disk temperature of a few tenths of a keV, and an X-ray luminosity of $L_X \geq 10^{40}\ erg\ s^{-1}$, suggest as much, contingent on the soft X-ray emission originating primarily from the inner-most region of a standard thin accretion disk. Confirmation of this source as a $<10^4\ M_\odot$ IMBH will further inform black hole-host galaxy scaling relations at stellar masses $\leq 10^{10}\ M_\odot$, supplement our understanding of black hole seeding and SMBH growth mechanisms, and help lay groundwork for continued identification of $\leq 10^4\ M_\odot$ black hole candidates.