A deep X-ray view of the bare AGN Ark120. IV. XMM-Newton and NuSTAR spectra dominated by two temperature (warm, hot) Comptonization processes.

Context. The physical characteristics of the material closest to supermassive black holes (SMBHs) are primarily studied through X-ray observations. However, the origins of the main X-ray components such as the soft X-ray excess, the Fe Kα line complex, and the hard X-ray excess are still hotly debated. This is particularly problematic for active galactic nuclei (AGN) showing a significant intrinsic absorption, either warm or neutral, which can severely distort the observed continuum. Therefore, AGN with no (or very weak) intrinsic absorption along the line of sight, so-called “bare AGN”, are the best targets to directly probe matter very close to the SMBH.

Aims. We perform an X-ray spectral analysis of the brightest and cleanest bare AGN known so far, Ark120, in order to determine the process(es) at work in the vicinity of the SMBH.

Methods. We present spectral analyses of data from an extensive campaign observing Ark120 in X-rays with XMM-Newton (4 × 120 ks, 2014 March 18–24), and NuSTAR (65.5 ks, 2014 March 22).

Results. During this very deep X-ray campaign, the source was caught in a high-flux state similar to the earlier 2003 XMM-Newton observation, and about twice as bright as the lower-flux observation in 2013. The spectral analysis confirms the “softer when brighter” behavior of Ark120. The four XMM-Newton/pn spectra are characterized by the presence of a prominent soft X-ray excess and a significant Fe Kα complex. The continuum is very similar above about 3 keV, while significant variability is present for the soft X-ray excess. We find that relativistic reflection from a constant-density, flat accretion disk cannot simultaneously produce the soft excess, broad Fe Kα complex, and hard X-ray excess. Instead, Comptonization reproduces the broadband (0.3–79 keV) continuum well, together with a contribution from a mildly relativistic disk reflection spectrum.

Conclusions. During this 2014 observational campaign, the soft X-ray spectrum of Ark120 below ~0.5 keV was found to be dominated by Comptonization of seed photons from the disk by a warm (kT_e ~ 0.5 keV), optically-thick corona (τ ~ 9). Above this energy, the X-ray spectrum becomes dominated by Comptonization from electrons in a hot optically thin corona, while the broad Fe Kα line and the mild Compton hump result from reflection off the disk at several tens of gravitational radii.