Intrinsic AGN Spectral Energy Distributions

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Abstract. AGN exhibit a variety of spectral energy distributions whose shapes depend on the intrinsic properties of the AGN, the extinction and absorption suffered by the nuclear radiation and the contribution of the host galaxy. Here, the intrinsic AGN spectral energy distributions of a hard X-ray selected sample of AGN from the XMDS are characterized after removing the host contribution and taking into account the effects of obscuration and absorption. We find that the intrinsic AGN spectral energy distributions can differ in their mid-infrared-to-X-ray luminosity ratios.

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GOAL, SAMPLE AND SED CLASSES

AGN spectral energy distributions (SEDs) are determined by the AGN luminosity, the amount of obscuration, and the type and luminosity of the host galaxy. Here, we investigate whether also the intrinsic AGN SED can vary and play a role in dictating the AGN type, and whether its shape is related to the AGN luminosity and obscuration. For this study, we selected a sample of AGN detected in the hard X-ray band in the XMM-*Newton* Deep Medium survey [XMDS; 1]. The sample contains 264 AGN with multi-wavelength data from infrared (IR) to X-rays. Spectroscopic redshifts are available for half of the sample, and photometric redshifts for the rest [1]. Each AGN optical-IR SED is classified on the basis of its best-fit template in one of the following 4 classes: AGN1 (corresponding to type 1 AGN templates), AGN2 (corresponding to templates of obscured AGNs), Sey1.8 (corresponding to templates of Seyfert galaxies), and SF (corresponding to galaxy templates). We find that sources with SEDs that are best-fitted by AGN1 or Sey1.8 templates exhibit, on average soft X-ray spectra, implying little or no absorption, while those best-fitted by AGN2, or SFG templates are characterized, on average, by hard X-ray spectra, indicating absorption (see Fig. 1).

AGN INTRINSIC SED

We divide the sample in 4 groups based on the SED class and each group in a low and a high luminosity sub-group so that the median absorption-corrected X-ray luminosity is the same for all 4 low-L_X, and all 4 high-L_X sub-groups: $<L^{corr}_{2-10\,keV}> = 10^{43.9}$ ergs s^{-1}and $<^{corr}L_{2-10\,keV}> = 10^{44.4}$ ergs s^{-1}, respectively. The median SEDs of the 8 sub-groups (4 SED classes $\times$ 2 L_X) are shown in Fig. 1. For each median SED we estimate the host galaxy contribution assuming a spiral (Sc) template and requiring that the SED resulting from the difference between total and host luminos-

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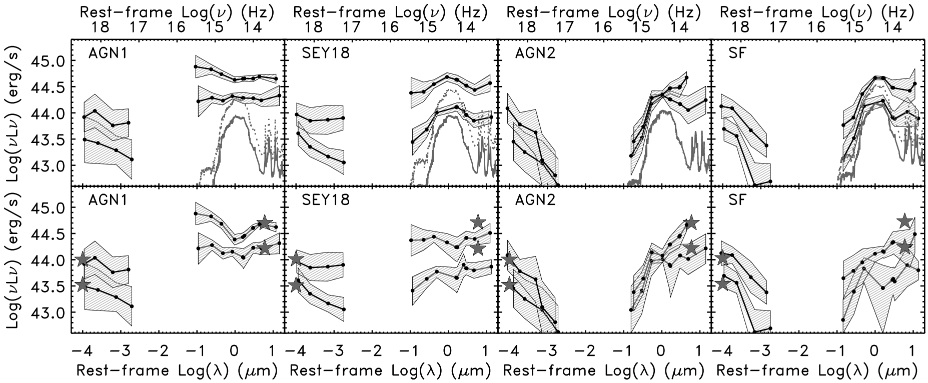

FIGURE 1. *Top panels:* Median SEDs regrouped by class (from left to right: AGN1, Sey18, AGN2, and SF) and X-ray luminosity (top shaded area: $<L^{corr}_{2-10\,keV}>=10^{44.4}$ ergs s^{-1}; bottom shaded area: $<L^{corr}_{2-10\,keV}>=10^{43.9}$ ergs s^{-1}). The dotted and solid lines represent the host galaxy contribution to the high- and low-L_X sub-groups, respectively. *Bottom panels:* same as in the top panels, but after subtracting the host contribution. The star symbols represent $\nu L_{6\mu m}/\nu L_{12\,keV} = 5$ and are normalized at $\nu L_{12\,keV}$. Note that the Sey1.8 and SF median SEDs are characterized by lower $\nu L_{6\mu m}/\nu L_{12\,keV}$ ratios.

ity satisfies $L_\nu(3\,\mu m)/L_\nu(1.6\,\mu m) = 2.8$ (equivalent to $L_\nu \propto \lambda^{1.65}$). This luminosity ratio roughly corresponds to what is expected for unobscured nuclear emission. Note that a different host galaxy template would make a difference only at UV-optical wavelengths and at $\lambda > 5\,\mu m$, e.g. at $6\,\mu m$ the host flux can be 0.4–1.3 times the current value. The estimated host contribution is subtracted from the total SED and the difference yields the intrinsic AGN SED of each sub-group. We find that the AGN intrinsic SEDs do not vary significantly within the same class as a function of luminosity, but they differ among the 4 classes. The AGN intrinsic SEDs become redder in the optical and harder in X-rays going from AGN1, to Sey1.8, AGN2, and SFs. These differences can be explained by effects of obscuration, but we also notice that the mid-IR-to-X-ray luminosity ratio, i.e. $\nu L_{6\mu m}/\nu L_{12\,keV}$, which is not significantly affected by obscuration, differs across the 4 classes (see red stars in Fig. 1), being $\sim$5–6 in AGN1 and AGN2, and $\sim$1.5–3 in Sey1.8 and SFs. Hence, AGN best-fitted by Sey1.8 and SFG templates are more efficient X-ray emitters or less efficient mid-IR emitters than those best-fitted by AGN1 and AGN2 templates. Finally, SFs seem to be the obscured counterparts of Sey1.8, and AGN2 the obscured counterparts of AGN1.

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