The spectral energy distribution of the central parsecs of the nearest AGN

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1. Abstract

Spectral energy distributions (SEDs) of the central few tens of parsec region of some of the nearest, most well studied, active galactic nuclei (AGN) are presented. These genuine AGN-core SEDs, mostly from Seyfert galaxies, are characterised by two main features: an IR bump with the maximum in the 2-10 $\mu$m range, and an increasing X-ray spectrum with frequency in the 1 to $\sim$200 keV region. These dominant features are common to Seyfert type 1 and 2 objects alike. In detail, type 1 AGNs are clearly distinguished from type 2s by their high spatial resolution SEDs: type 2 AGN exhibit a sharp drop shortward of 2 $\mu$m, with the optical to UV region being fully absorbed; type 1s show instead a gentle 2 $\mu$m drop ensued by a secondary, partially-absorbed optical to UV emission bump. On the assumption that the bulk of optical to UV photons generated in these AGN are reprocessed by dust and re-emitted in the IR in an isotropic manner, the IR bump luminosity represents $\gtrsim 70\%$ of the total energy output in these objects, the second energetically important contribution are the high energies above 20 keV.

Galaxies selected by their warm infrared colours, i.e. presenting a relatively-flat flux distribution in the 12 to 60 $\mu$m range have often being classified as active galactic nuclei (AGN). The results from these high spatial resolution SEDs question this criterion as a general rule. It is found that the intrinsic shape of the infrared spectral energy distribution of an AGN and inferred bolometric luminosity largely depart from those derived from large aperture data. AGN luminosities can be overestimated by up to two orders of magnitude if relying on IR satellite data. We find these differences to be critical for AGN luminosities below or about $10^{44}$ erg s$^{-1}$. Above this limit, AGNs tend to dominate the light of their host galaxy regardless of the integration aperture size used. Although the number of objects presented in this work is small, we tentatively mark this luminosity as a threshold to identify galaxy-light- vs AGN-dominated objects.

2. Introduction

The study of the spectral energy distributions (SED) over the widest possible spectral range is an optimal way to characterise the properties of galaxies in general. Covering the widest spectral
range is the key to differentiate physical phenomena which dominate at specific spectral ranges: e.g. dust emission in the IR, stellar emission in the optical to UV, non-thermal processes in the X-rays and radio, and to interrelate them as most of these phenomena involve radiation reprocessing from a spectral range into another. The availability of the SED of a galaxy allows us to determine basic parameters such as its bolometric luminosity (e.g. Elvis et al. 1994; Sanders & Mirabel 1996; Vasudevan & Fabian 2007), and via modelling of the SED, its star formation level, mass and age (e.g. Bruzual & Charlot 2003; Rowan-Robinson et al. 2005; Dale et al. 2007).

The construction of bona-fide SEDs is not easy as it involves data acquisition from different ranges of the electromagnetic spectrum using very different telescope infrastructure. That already introduces a further complication as the achieved spatial resolution, and with it the aperture size used, vary with the spectral range. SEDs based on the integration of the overall galaxy light may be very different from those extracted from only a specific region, for example the nuclear region. In this specific case, the aperture size matters a lot, as different light sources, such as circumnuclear star formation, the active nucleus, and the subjacent galaxy light, coexist on small spatial scales and may contribute to the total nuclear output with comparable energies (e.g. Genzel et al. 1998; Reunanen et al. 2009).

In the specific case of SEDs of AGN, it is often assumed that the AGN light dominates the integrated light of the galaxy at almost any spectral range and for almost any aperture. This assumption becomes mandatory at certain spectral ranges, such as the high energies, the extreme UV or the mid-to-far-IR, because of the spatial resolution limitations imposed by the available instrumentation, which currently lies in the several arcsecs to arcminutes at these wavelengths. In the mid- to far- IR in particular, the available data, mostly from IR satellites, are limited to spatial resolutions of a few arcsecs at best. Thus, the associated SEDs include the contribution of the host galaxy, star forming regions, dust emission and the AGN, with the first two components being measured over different spatial scales in the galaxy depending on the object distance and the spatial resolution achieved at a given IR wavelength.

In spectral ranges where high spatial resolution is readily available, the importance, if not dominance, of circumnuclear star formation relative to that of the AGN has become clear in the UV to optical range (e.g. Munoz-Marín et al. 1997), or in the near-IR (Genzel et al. 1998). In the radio regime, the comparison of low- and high- spatial-resolution maps shows the importance of the diffuse circumnuclear emission and the emission from the jet components with respect to that of the core itself (e.g. Roy et al., 1994; Elmouttie et al. 1998; Gallimore et al. 2004; Val, Shastri & Gabuzda, 2004). Even with low resolution data a major concern shared by most works is the relevance of the host galaxy contribution to the nuclear integrated emission from the UV to optical to IR. To overcome these mixing effects introduced by poor spatial resolution, different strategies or assumptions have been followed by the community. In quasars, by their own nature, the dominance of the AGN light over the integrated galaxy light at almost any wavelength is assumed; conversely, in lower luminosity AGN, the contribution of different components is assessed via modelling of the integrated light (Edelson & Malkan 1986; Ward et al. 1987; Sanders et al. 1988; Elvis et al. 1994;
Buchanan et al. 2006 among others).

In this paper, we attempt to provide a best estimate of the AGN light contribution on very nearby AGN by using very high spatial resolution data over a wide range of the electromagnetic spectrum. Accordingly, SEDs of the central few hundred parsec region of some of the nearest and brightest AGN are compiled. The work is motivated by the current possibility to obtain subarcsec resolution data in the near-to-mid-IR of bright AGN, and thus at comparable resolutions to those available with radio interferometry and the HST in the optical to UV wavelength range. This is possible thanks to the use of adaptive optics in the near-IR, the diffraction limit resolutions provided by 8-10 m telescopes in the mid-IR as well as interferometry in the mid-IR.

The selection of targets is driven by the requirements imposed by the use of adaptive optics in the near-IR, which limits the observations to the availability of having bright point-like targets with magnitudes $V < 15$ mag in the field, and the current flux detection limits in mid-IR ground-based observations. AGN in the near universe are sufficiently bright to satisfy those criteria. The near-to mid-IR high resolution data used in this work come mostly from the ESO Very Large Telescope (VLT), hence this study relies on Southern targets, all well known objects, mostly Seyfert galaxies: Centaurus A, NGC 1068, Circinus, NGC 1097, NGC 5506, NGC 7582, NGC 3783, NGC 1566 and NGC 7469. For comparison purposes, the SED of the quasar 3C 273 is also included.

The compiled SEDs make use of the highest spatial resolution data available with current instrumentation across the electromagnetic spectrum. The main sources of data include: VLA-A array and ATCA data in radio, VLT diffraction-limited images and VLTI interferometry in the mid-infrared (mid-IR), VLT adaptive-optics images in the near-infrared, and $HST$ imaging and spectra in the optical-ultraviolet. Although X-rays and $\gamma$-rays do not provide such a fine resolution, information when available for these galaxies are also included in the SEDs on the assumption that above 10 keV or so we are sampling the AGN core region. Most of the data used comes from the Chandra and INTEGRAL telescopes.

The novelty in the analysis is the spatial resolutions achieved in the infrared (IR), with typical full-width at half-maximum (FWHM) $\lesssim 0.2$ arcsec in the 1–5 $\mu$m, $<0.5$ arcsec in the 11 – 20 $\mu$m. The availability of IR images at these spatial resolutions allow us to pinpoint the true spatial location of the AGN – which happens not to have an optical counterpart in most of the type 2 galaxies studied – and extract its luminosity within aperture diameters of a few tens of parsec. The new compiled SEDs are presented in sect. 3. Some major differences but also similarities between the SEDs of type 1 and type 2 AGN arise at these resolutions. These are presented and discussed in sections 4 and 5. The SEDs and the inferred nuclear luminosities are further compared with those extracted in the mid-to-far IR from large aperture data from IR satellites, and the differences discussed in sect. 6.

Throughout this paper, $H_0 = 70$ km s$^{-1}$ Mpc$^{-1}$ is used. The central wavelength of the near-IR broad band filters used are: $I$-band (0.8 $\mu$m), $J$-band (1.26 $\mu$m), $H$-band (1.66 $\mu$m), $K$-band (2.18 $\mu$m), $L$-band (3.80 $\mu$m) and $M$-band (4.78 $\mu$m).
3. The high spatial resolution SED: data source

This section describes the data used in building the high spatial resolution SEDs. Each AGN is analysed in turn, and the compiled SED is shown in Fig. 1. The data used in the SEDs are listed per each object in tables 3 to 11. For each AGN, an upper limit to the core size determined in the near-IR with adaptive optics and/or in the mid-IR with interferometry is provided first. The data sources used in constructing the respective SEDs are described next. When found in the literature, a brief summary of the nuclear variability levels especially in the IR is provided. This is mostly to assess the robustness of the SED shape and integrated luminosities across the spectrum. Finally, as a by product of the analysis, an estimate of the extinction in the surrounding of the nucleus based on near-IR colours derived from the high spatial resolution, mostly $J-K$, images is provided. The colour images used are shown in Fig. 2. These are relative extinction values, resulting after comparing the average colour in the immediate surrounding of the nucleus with that at further galactocentric regions, usually within the central few hundred parsecs. These reference regions are selected from areas presenting lower extinction as judged from a visual inspection of the colour images. The derived extinction does not refer to that in the line of sight of the nucleus, which could be much larger - we do not compare with the nucleus colours but with those in its surrounding. The simplest approach of considering a foreground dust screen is used. The extinction law presented in Witt et al. (1992), for the UV to the near-IR, and that in Rieke & Lebofsky (1985), for the mid-IR, are used.

For some objects, the near-IR adaptive optics data used to compile the SED are presented here for the first time. For completeness purposes, table 12 is a list of all the adaptive optics VLT/NACO observations used in this work. The list of filters and observations date are provided. For some objects these data was already presented in the reference quoted in this table. The nucleus of these AGN was in all cases bright enough to be used as a reference for the adaptive optics system to correct for the atmospheric turbulence. The optical nuclear source was used in all cases with the exception of Centaurus A and NGC 7582, for which the IR nucleus was used instead. The observation procedure and data reduction for the objects presented here for the first time are the same as those discussed in detail in the references quoted in table 12, we refer the interested reader to those for further details.

There are five type 2, three type 1 and an intermediate type 1/LINER AGN in the sample, in addition to the quasar 3C 273, included for comparative purposes. The AGN is unambiguously recognised in the near-IR images of all objects as the most outstanding source in the field of 26 x 26 arcsecs$^2$ covered by the VLT/NACO images. This is especially the case for the type 2 sources where the AGN reveals in full realm from 2 $\mu$m longwards. The comparable resolution of the NACO-IR- and the HST-optical- images allows us to search for the optical counterpart of the IR nucleus, in some cases using accurate astrometry based on other point like sources in the field (e.g Prieto et a;
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2004; Fernandez-Ontiveros et al. 2009). In all the type 2 cases analysed the counterpart optical emission is found to vanish shortward of 1 $\mu$m. Accordingly, all the type 2 SEDs show a data gap in the optical - UV region. In addition all the SEDs show a common data gap spanning the extreme UV - soft X-rays region, due to the observational inaccessibility of this spectral range, and in the mid-IR to millimetre range due to the lack of data at subarcsec resolution scales. Surprisingly, for some of these well studied objects, neither radio data at subarcsec scales exist, e.g. Circinus galaxy. In these cases, to get nevertheless an estimate on the nuclear power in this range, the available radio data is included in the SED.

The SED are further complemented with available data in the X-rays, which extends up to 100 - 200 keV for all sources. Only for Cen A and 3C 273, the SEDs are further extended to the gamma-rays, these being the only two so far detected at these high energies.

Centaurus A

Centaurus A is the nearest radio galaxy in the Southern hemisphere. The adopted scale is 1 arcsec $\sim$ 16 pc (D = 3.4 Mpc; Ferrarese et al. 2007). The nucleus of this galaxy begins to show up in the optical longward of 0.7 $\mu$m (Marconi et al. 2000) and so far remains unresolved down to a size $<\!\!<\!\!<1$ pc FWHM in the 1 – 10 $\mu$m range (from VLT adaptive optics near-IR imaging by Haering-Neumayer et al. 2006 and VLT interferometry in the mid-IR by Meisenheimer et al. 2007).

The currently compiled SED of Cen A core is shown in Fig. 1. The radio data are from VLBA quasi simultaneous observations collected in 1997 at 22.2 and 8.4 GHz (March epoch was selected) and in 1999 at 8.4, 5 and 2.2 GHz, in all cases with resolution of a few milliarcsec (Tingay et al. 2001 and Tingay and Murphy, 2001). These spatial resolutions allow for a better separation of the core emission from the jet. The peak values reported by the authors are included in the SED.

In the millimetre range, peak values from SCUBA in the 350–850 $\mu$m range from Leeuw’s et al. (2002) are included in the SED. SCUBA has poor spatial resolution, FWHM $\sim$ 10–15 arcsec, however we take these measurements as genuine core fluxes as they follow fairly well the trend defined by the higher resolution data at both radio and mid-IR wavelengths. This common trend is a strong indication that the AGN is the dominant light source in the millimetre range.

In the mid-IR range, VLT / VISIR diffraction-limited data, taken on March 2006, at 11.9 and 18.7 $\mu$m, from Reunanen et al. (2009) are included in the SED. Further mid-IR data are from VLTI / MIDI interferometric observations in the 8 – 12 $\mu$m range taken on February and May 2005 with resolutions of 30 mas (Meisenheimer et al. 2007). The visibility’s analysis indicates that at least 60% of the emission detected by MIDI comes from an unresolved nucleus with a size at 10 $\mu$m of FWHM $< 1$ pc. This is also confirmed by more more recent MIDI observations by Burtscher et al (2009). The SED includes two sets of MIDI fluxes measured directly in the average spectrum from both periods: 1) the total integrated flux in the MIDI aperture (0.52 $\times$ 0.62 arcsec); 2) the core fluxes measured on the correlated spectrum. At 11.9 $\mu$m, the MIDI total flux and the VISIR
nuclear flux, both from comparable aperture sizes, differ by 15%. The difference is still compatible with the photometry errors which in particular may be large in the MIDI spectrum-photometry.

The near-IR is covered with VLT/ NACO adaptive optics data taken in J-, H-, K- and L-bands, and in the narrow-band line-free filter centred at 2.02 µm. These are complemented with HST/WFPC2 data in the I-band (Marconi et al. 2000). Shortward of this wavelength, Cen A’s nucleus is unseen. An upper limit derived from the HST / WFPC2 image at 0.5 µm is included in the SED.

At high energies, Cen A’s nucleus becomes visible again, as well as its jet. The SED includes the 1 KeV nuclear flux extracted by Evans et al. (2004) from Chandra observations in 2001 and and average of the 100 keV fluxes derived by Rothschild et al. (2006) from INTEGRAL observations collected in 2003–2004. In the gamma-rays, the SED includes COMPTEL measurements in the 1 – 30 MeV range taken during the 1991–1995 campaign by Steinle et al. (1998).

For comparative purposes, Fig. 1 includes large aperture data -identified with crosses- in the mid to far IR region selected from ISO (Stickel et al. 2004) and IRAS (Sanders et al. 2003). For consistency purposes, given the poor spatial resolution of the SCUBA data, these are also labelled with crosses in the SED.

Cen A is a strongly variable source at high energies, where flux variations could be up to an order of magnitude (Bond et al. 1996). However, during the COMPTEL observations used in the SED the observed variability on the scales of few days is reported to be at the 2 sigma level at most (Steinle et al. 1998). Combining OSSE, COMPTEL and EGRET, the gamma-ray luminosity (50 keV - 1 GeV) varies by 40%. No report on variability monitoring of this source in the IR was found. The comparison between the VLT / VISIR data used in this work and equivalent mid-IR data obtained four years apart, 2002, by Whysong & Antonucci ( 2004) using Keck and Siebenmorgen et al. (2004) using ESO / TIMMI2, indicates a difference with VISIR in the 40 to 50% range. Cen A’s nucleus is the single source in this study which high spatial resolution SED, from radio to millimetre to IR, can be fit with a single synchrotron model (Prieto et al. 2007; see also end of sect. 7 ). Thus a flux difference of a factor of 2 in the IR is consistent with genuine nuclear variability and the dominance of a non-thermal component in the IR spectral region of this nucleus.

Relative extinction values in the nuclear region of Cen A were measured from VLT / NACO J–K (Fig. 2) and H–K colour maps. The average reddest colours around the nucleus are J–K = 1.5, J–H = 1.5 and the bluest colours within ~ 100 pc distance from the nucleus, are J–K = 0.68 and J–H = 1.04. Taking these as reference colours for Cen A stellar population, the inferred extinction around the nucleus is \( A_V \sim 5 – 7 \) mag. By comparison, the extinction inferred from the depth of the silicate 9.6 µm feature in the line of sight of the nucleus – from the VLT / MIDI correlated spectra – is a factor 2 to 3 larger, \( A_V \sim 13 - 19 \) mag (see Table 2).
Fig. 1.— Fig. 1: SEDs of the central parsec-scaled region of the AGN in this study: filled points represent the highest spatial resolution data available for these nuclei; the thin V-shape line in the mid-IR region shown in some SEDs corresponds to the spectrum of an unresolved source as measured by VLTI / MIDI (correlated flux); Crosses refer to large aperture data in the mid-IR (mostly from IRAS and ISO), and the millimetre when available. The frequency range is the same in all plots except for Cen A and 3C 273 which extends up to the gamma-rays. The continuous line in 3C 273 plot is the SED of this object after applying an extinction $A_v = 15$ mag.
Fig. 1.— Continued
Fig. 2.— Near-IR colour maps of the galaxies in this study. Most are $J - K$, or $J - K$ narrow band $K$ maps when available. Only the very central 2 to 3 arcsec radius FoV is shown. The small bar at the bottom of each panel indicates the spatial resolution of the maps, and in turn the upper limit size to the AGN core in the $K$-band.
Fig. 2.— Continued
Circinus is the second closest AGN in the Southern Hemisphere. The adopted scale is 1 arcsec \(\sim 19\) pc \(D = 4.2\) Mpc, Freeman et al. 1977). Circinus’ nucleus is the only one in our sample that is spatially resolved in the VLT/NACO adaptive optics images from 2 \(\mu m\) onward. The nucleus resolves into an elongated, \(\sim 2\) pc size, structure oriented perpendicular to the ionisation-gas cone axis (Prieto et al. 2004). Its spectral energy distribution is compatible with dust emission at a characteristic temperature of 300 K; this structure has thus most of the characteristics of the putative nuclear torus (Prieto et al. 2004). Further VLTI/MIDI interferometry in the 8 – 12 \(\mu m\) range also resolves the central emission into a structure of the same characteristics (Tristram et al. 2007).

Circinus’ SED is shown in Fig. 1. The highest spatial resolution radio data available for this source – in the range of a few arcsecs only – is presented by Elmouttie et al. (1998). Because of this poor resolution, only the central peak values given by that reference are used in the SED. The beam sizes at the available frequencies are \(6 \times 5.4\) arcsec at 20 cm, \(3.4 \times 3.1\) arcsec at 13 cm, \(1.4 \times 1.3\) at 6 cm, and \(0.9 \times 0.8\) arcsec at 3 cm.

Mid-IR nuclear fluxes are taken from VLT/VISIR diffraction-limited images at 11.9 and 18.7 \(\mu m\) (Reunanen et al. 2009). Further mid-IR data are taken from VLTI/MIDI interferometry spectra covering the 8 -13 \(\mu m\) range (Tristram et al. 2007). Two sets of MIDI data are included in the SED: the correlated fluxes, which correspond to an unresolved source detected with visibility of 10\%, and the total fluxes that are measured within the MIDI 0.52 \(\times\) 0.62 arcsec slit. In the latter case, only fluxes at 8 and 9.6 \(\mu m\) are included. For sake of simplicity, flux measurements at the longer MIDI wavelengths are not included as they are in very good agreement with the VISIR flux at 11.9 \(\mu m\) within 5\%. Near-IR nuclear fluxes, in the 1 – 5 \(\mu m\) range, are taken from VLT/NACO adaptive optics images by Prieto et al. (2004). Shortward of 1 \(\mu m\), Circinus’ nucleus is undetected, an upper limit at 1 \(\mu m\) derived from NACO J-band image is included in the SED.

At the high energies, the SED includes the ROSAT 1 keV flux after correction for the hydrogen column density, derived by Contini et al. (1998), and INTEGRAL fluxes at different energy bands in the 2 – 100 keV range (Beckmann et al. 2006).

For comparative purposes, the SED includes large aperture data in the mid to far IR region selected from IRAS (Moshir et al. 1990).

There are no reports on significant variability in Circinus at near-IR wavelengths. In comparing the data analysed in this work, we find that the 12 \(\mu m\) nuclear flux measured in 2002 by Siebenmorgen et al. (2004) and that of VLT/VISIR collected four years apart, differ by less than 5\%. At the high energies, in the 20 – 40 keV range, Soldi et al (2005) report a 10\% maximum variability in a time interval of 2 days.

An estimate of the extinction toward the nucleus is derived from the VLT/NACO J–2.42 \(\mu m\) colour map (Fig. 2 ). In the surroundings of the nucleus \(J–2.42\mu m > 2.2\) is found. The colours
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become progressively bluer with increasing distance and in relatively clean patches in the central 150 pc radius the average value is $J - 2.42 \mu m \sim 1$. The colours comparison yields a relative extinction of $A_V \sim 6$ mag, assuming a foreground dust screen. Because of the finest scales, a few parsecs, at which Circinus’s nucleus is studied, Prieto et al. (2004) further considered a simple configuration of the dust being mixed with the stars, in which case, an extinction of $A_V \sim 21$ mag is found. This value is more in line with the range of extinctions derived from the optical depth of the 9.6 $\mu m$ silicate feature measured in the VLTI / MIDI correlated spectrum, $22 < A_V < 33$ mag (Tristram et al. 2007).

NGC 1068

NGC 1068, Circinus and Cen A are the brightest Seyfert nuclei in the sample but NGC 1068 is a factor four further away, at a distance of 14.4 Mpc (Bland-Hawthorn et al. 1997). The adopted scale is 1 arcsec $\sim 70$ pc.

NGC 1068’s radio core – identified with the radio source S1 – is resolved at 5 and 8.4 GHz into an elongated, $\sim 0.8$ pc disk-like structure, oriented perpendicular to the radio jet axis (Gallimore, Baum & O’Dea 2004). VLTI / MIDI interferometry in the 8 – 12 $\mu m$ range resolves the nucleus into two components: an inner component of about 1 pc size and a cooler, 300 K disk-like component, with size of 3 x 4 pc (Raban et al. 2009). At 2$\mu$m speckle observations by Weigelt et al. (2004) resolve the central emission into a compact core with size $1.3 \times 2.8 pc$, and a north-western and south-eastern extensions. Shortward of 1$\mu$m, and on the basis of the SED discussed below, NGC 1068’s nucleus is fully obscured.

The highest spatial resolution SED of NGC 1068’ nucleus from radio to optical is presented in Hoenig, Prieto & Beckert (2008). The authors provide a fair account of the continuum spectrum from radio to IR to optical SED, by including in their model the major physical processes that must contribute to the integrated core emission: synchrotron, free-free emission from ionised gas and the dust-torus emission. The SED included here is that presented in Hoenig et al. but further complemented with high energy data. Furthermore, the IR nuclear photometry is extracted in a different way: the nucleus of NGC 1068 in the mid- to near- IR presents additional emission structure extending, particularly, North and South of it (Bock et al. 2000; Rouan et al. 2004). To minimise the contamination by this extended emission, the near-IR nuclear fluxes are here extracted within an aperture diameter comparable with the nuclear FWHM measured at the corresponding wavelength.

The SED is shown in Fig. 1. The radio data are taken from VLA observations at 43 GHz with 50 mas beam (Cotton et al. 2008) and 22 GHz with 75 mas beam from Gallimore et al. (1996), VLBA observations at 8.4 and 5 GHz from Gallimore et al. (2004), and VLBA at 1.7 GHz from Roy et al. (1998). 1 and 3 mm core fluxes are taken from Krips et al. (2006), and correspond to beam sizes larger than 1 arcsec, thus the may include the contribution from the jet. We still include
these data in the SED as the jet components have a steep spectrum (Gallimore et al. 2004), and thus their contribution to the core emission is expected to decrease at these frequencies.

In the mid-IR, the nuclear fluxes in the 8 to 18 $\mu$m range are from Subaru (Tomono et al., 2001), complemented with an additional nuclear flux at 25 $\mu$m from Keck (Bock et al. 2000). All these measurements are extracted from deconvolved images in aperture diameters of $\sim$ 200 mas. Despite the uncertainties inherited to the deconvolution process, we note that the fluxes derived by both group of authors at common wavelengths, each using different instrumentation and telescope, differ by < 30%. The SED also includes the 8 – 12 $\mu$m VLTI/MIDI correlated spectrum of the unresolved component sampled at four wavelengths. This correlated spectrum was derived from a 78 m baseline which provides a spatial resolution of about 30 mas (Jaffe et al. 2004). The total flux measured in the MIDI 500 mas slit render fluxes larger by a factor of 2 than those measured by Bock et al. and Tomono et al. in their 200 mas aperture. This difference is due to the inclusion in the MIDI slit of the light contribution from the nuclear extended emission of NGC 1068 mentioned above. Thus, the MIDI total fluxes are not included in the SED. Near-IR data, in the $1 - 5 \mu$m range, are from VLT / NACO adaptive optics images at $J$-, $H$-, $K$-, $M$- bands and the 2.42 $\mu$m narrow band line-free filter. The nucleus is unresolved at the achieved resolutions, the nuclear fluxes were extracted in aperture diameter comparable to the nucleus FWHM: 0.1 arcsec in $J$-, $K$- and 2.42 $\mu$m bands, 0.22 arcsec in $H$-band, 0.16 arcsec in $M$-band. The inspection of the VLT NACO J-band image indicates a relatively faint source at the position of the K-band nucleus, and thus we take the extracted J-band flux as an upper limit.

In the X-ray, the following measurements are included in the SED: Chandra 1 keV flux from Young, Wilson & Shopbell (2001), EXOSAT flux in the 2 – 10 keV range by Turner & Pounds (1989), and INTEGRAL data in the 20 – 40 keV and 40 – 100 keV bands from Beckmann et al. (2006).

The SED includes large aperture data in the mid- to far- IR from IRAS (Sanders et al. 2003) and ISO (Stickel et al. 2004) and in the sub-millimetre from Hildebrand et al. (1977).

Monitoring of the source in the near-IR by Glass (2004) indicates long-term variability, with an increase by a factor of two in flux in the period 1970 - 1995. Fig. 2 shows the VLT / NACO $J - 2.42-\mu m$ colour map. Contrary to other AGN in the sample, the nuclear region of NGC 1068 presents a lot of emission structure as seen in the colour map. The average colour around the centre is $J - 2.42-\mu m \sim 3$, and gets progressively bluer with increasing distance; at $\sim$ 150 pc radius, the average colour $J - 2.42-\mu m$ is $\sim 0.7$. Taking this value as intrinsic to the central region of the galaxy, the inferred extinction in the surrounding of the nucleus is $A_V \sim 10–12$ mag (Table 2). For comparison, the extinction derived from the depth of the silicate feature in the VLTI / MIDI correlated spectrum is $A_V \sim 7$ mag for the more external, 3 x 4 pc cooler component, in rather good agreement with the extinction in the nuclear surrounding. Conversely, the extinction derived for the hotter parsec-scale inner component is $A_V \sim 30$ mag (Raban et al. 2009).
NGC 1097

NGC 1097 is one of the nearest LINER / Seyfert type 1 galaxy in the Southern Hemisphere, at a comparable distance as NGC 1068. The adopted scale is 1 arcsec $\sim$ 70 pc (distance = 14.5 Mpc, Tully 1988). The nucleus is visible at all wavelengths from UV to radio. In the IR, it is unresolved down to the highest resolution achieved in this object with VLT / NACO: FWHM $\sim$ 0.15 arcsecs in $L$-band (< 11 pc).

The SED is shown in Fig. 1. At radio waves, the following measurements are included in the SED: sub-arcsec resolution data from VLA A-array at 8.4 GHz (Thean et al. 2000) and at 8.4 GHz, the latter with a beam resolution of $0.66\times0.25\text{arcsec}^2$ (Orienti & Prieto, 2009), VLA B-array data at 1.4 GHz with beam resolution of $2.5\times1.5\text{arcsec}^2$ (Hummel et al. 1987), and VLA B-array archived data at 15 GHz re-analysed in Orienti & Prieto (2009), and for which a final beam resolution of $1.15 \times 0.45 \text{arcsec}^2$ is obtained. Despite the relatively larger beam of VLA B-array data, we believe the associated nuclear fluxes to be fully compatible with those derived with the finer scale VLA A-array data. This is based on the analysis of equivalent VLA A- and B-array data at 8.4 GHz which yielded same nuclear fluxes, indicating that the nucleus is unresolved.

The mid-IR is covered with diffraction-limited resolution data from the VLT / VISIR images at 11.88 and 18.72 $\mu$m (Reunanen et al. 2009). The near-IR, 1 to 4 $\mu$m, is covered with VLT/NACO adaptive optics images at $J$, $H$, $K$- and $L$- bands, which have spatial resolutions FWHM $<\sim 0.2$ arcsec (Prieto et al. 2004, and this work).

Optical and UV data were extracted from archival HST / WFPC2 F220W and F555W images and HST/ACS F814W image. Further UV data available from IUE and GALEX were not considered as their spatial resolution beams, 20 and 6 arcsecs FWHM respectively include emission from the prominent NGC 1097’s starforming ring located at 5 arcsec radius from the centre.

In the X-rays, the absorption-corrected fluxes derived by Therashima et al. (2002) in the ASCA 0.1–4 keV and 2–10 keV windows are used. Further observations at higher energies were not found in the literature.

For comparison purposes, the SED includes large aperture data, for the mid-IR to the millimetric wavelengths, from IRAS, Spitzer and SCUBA, all taken from Dale et al. (2007).

NGC 1097 has shown variability in the optical, exhibiting broad emission lines. To our knowledge, there is no report on variability at any other spectral range.

Using the VLT / NACO colour maps $J$–$H$ and $H$–$K$, Prieto, Maciejewski & Reunanen (2005) estimate a moderate extinction of $A_V \sim 1$ mag towards the centre. To estimate this extinction, the colours in the surrounding of the nucleus were compared with those at further locations, inward the circumnuclear star forming ring and not contaminated by the nuclear dust filaments. These
filaments are readily seen in the NACO $J$–$K$ colour map shown in Fig. 2.

**NGC 5506**

This is a Seyfert type 1.9 nucleus in an edge-on disk galaxy, and largely covered by dust lanes. As it is found in our VLT / NACO adaptive optics images, the nucleus dominates the galaxy light at IR wavelengths from 1 $\mu$m onward, but there is no equivalent counterpart in HST optical images (Malkan et al. 1998). In the 1 to 20 $\mu$m range, the nucleus is unresolved down to the best spatial resolution achieved with the NACO observations, that is the $K$-band which sets an upper limit for the size of the source of FWHM $\sim$ 0.10 arcsecs (<13 pc). The adopted scale is 1 arcsec $\sim$ 126 pc (redshift taken from NED).

The SED is shown in Fig. 1. VLBA maps show the nuclear region resolved in three blobs. In the SED, the emission from the brightest and smallest of the three blobs, also with the flattest spectral index ($\alpha = +0.06$), called BO component in Middelberg et al. (2004), is taken into account. Reported peak values from VLBA and VLBI at 8.3, 5 and 1.7 GHz, with some of them taken at multiple epoch, are all included in the SED. In addition, PTI (Parkes Tidbinbilla Interferometer) data at 2.3 GHz from Sadler et al. (1995) from a 0.1 arcsec beam is also included.

In the mid-IR, the extracted nuclear fluxes from VLT / VISIR diffraction-limited data at 11.8 and 18.7 $\mu$m from Reunanen et al. (2009) are included. Additional fluxes at 6 and 9.6 $\mu$m were directly measured on the 6 – 13 $\mu$m spectrum published in Siebenmorgen et al. (2004, their Fig. 15), which combines ESO/TIMMI2 and ISOPHOT data. Although the ESO/ TIMMI2 data correspond to a 1.2 arcsec slit-width, it perfectly joins the large aperture ISOPHOT spectrum, thus the measured fluxes should be rather genuine of the pure nuclear emission. The near-IR 1 – 4 $\mu$m data are extracted from the VLT / NACO adaptive optics images. As the images are dominated by the central source with bare detection of the host galaxy, the nuclear fluxes were integrated within aperture sizes of 0.5 arcsec in diameter.

Below 1 $\mu$m, the nucleus is undetected, an upper limit in the $R$-band derived from HST / WFPC2 archive images is set as a reference in the SED. In the X-rays, INTEGRAL fluxes in the 2 – 100 keV range from Beckmann et al. (2006) are included. The soft X-rays, 0.2 – 4 keV, are covered with Einstein data (Fabbiano et al. 1992).

For comparison purposes, large aperture data from the mid- to far- IR, collected with IRAS (Sanders et al. 2003) are included in the SED.

There is no apparent nuclear variability in the IR over a time-scale of years. This follows from the existing agreement between ISOPHOT, IRAS, ground based spectra taken in 2002 (Siebenmorgen et al. 2004), and VLT / VISIR data taken in 2006, all furthermore having very different spatial resolution. The nucleus is however highly variable in the X-rays by factors of $\sim$ 2 in scales of a few minutes (Dewangan & Griffiths 2005).
Fig. 2 shows a VLT / NACO $J-K$ colour image of the central 2.5 kpc region. The nucleus and diffraction rings are readily seen, these are further surrounded by a diffuse halo sharply declining in intensity. Taken as a reference $J-K \lesssim 1.8$ as the average colour in the outermost regions in this halo, $\sim 150$ pc radius, and $J-K \sim 2.8$ that in the surrounding of the nucleus, the comparison of both yields a relative extinction towards the centre of $A_V \sim > 5$ mag. Due to the faintness of the galaxy, the true extinction around the nucleus might be much higher than that. Most probable the colour of the halo is largely affected by the nucleus PSF wings. For comparison, the extinction derived from the depth of the silicate feature at 9.6 $\mu$m in Siebenmorgen’s et al. 1.2 arcsec slit-width spectrum is $A_V \sim 15$ mag (Table 2).

**NGC 7582**

This is a Seyfert type 2 nucleus surrounded by a ring of star forming regions. The East side of the galaxy is largely obscured by dust lanes. These fully obscure the nucleus and many of the starforming regions at optical wavelengths. Most of them and a very prominent nucleus are revealed in seeing-limited VLT / ISAAC near-IR images (Prieto et al. 2002). The achieved spatial resolution in the current adaptive optics images allow us for very accurate astrometry on the position of the nucleus, by taking as a reference the star forming regions identified in both the IR and HST optical images. In this way, a weak optical counterpart source at the IR nucleus location is found, along with a rich network of new star forming regions, some as close as 0.5 arcsec (50 pc) from the centre, the furthest being seen up to about 320 pc radius. The ages and masses of these regions are analysed in Fernandez-Ontiveros et al. (in preparation). The nucleus is unresolved down to the best resolution achieved in these observations, which yield a FWHM $\sim 0.1$ arcsec ($< 11$ pc) at 2 $\mu$m. The adopted scale is 1 arcsec $\sim 105$ pc (taking the redshift from NED).

The SED is shown in Fig. 1. The published radio maps at 8.4 and 5 GHz obtained with the VLA-A array show a diffuse nuclear region (e.g. Thean et al. 2000). In an attempt to improve the spatial resolution, an unpublished set of VLA-A array data at those frequencies was retrieved from the VLA archive and analysed by filtering out the antennas that provide the lowest resolution. In this way, a nuclear point-like source, and some of the surrounding star forming knots could be disentangled from the diffuse background emission. The final beam resolution corresponds to a FWHM = 0.65 $\times$ 0.15 arcsec$^2$ at 8.4 GHz, and 0.96 $\times$ 0.24 arcsec$^2$ at 5 GHz (Orienti & Prieto 2009). The radio data used in the SED corresponds to the nuclear fluxes extracted from these new radio maps. There is no further high resolution radio data available for this galaxy.

Mid-IR nuclear fluxes are taken from the analysis done on diffraction-limited VLT/VISIR images at 11.9 and 18.7 $\mu$m by Reunanen et al. (2009). Additional measurements in the $8-12$ $\mu$m range are extracted from an ESO / TIMMI2 nuclear spectrum taken with an 1.2 arcsec slit width (Siebenmorgen et al. 2004). Although within this slit-width the contribution from the nearest
circumnuclear star forming regions is certainly included, the derived fluxes follow the trend defined by the higher spatial resolution VISIR and NACO data, which indicates the relevance of the AGN light within at least 50 pc radius (0.6 arcsec) from the centre. In the near-IR, 1 – 4 \( \mu \)m, the nuclear fluxes are extracted from a HST / NICMOS H-band image, and the VLT / NACO- narrow-band images at 2.06 \( \mu \)m and 4.05 \( \mu \)m, and L-band image, using aperture diameters of 0.3 arcsecs. This aperture is about twice the average FWHM resolution obtained in the NACO images. In the optical, NGC 7582’s nucleus becomes very absorbed. We find a weak optical counterpart to the K-band nucleus in the HST/ WFPC2 F606W image (Malkan, Gorjian & Tam 1998). The estimated flux was derived by integrating the emission in an aperture size of 0.3 arcsecs in diameter centered at the location of the IR nucleus.

A bright nuclear source becomes visible again at the higher energies. The nuclear fluxes included in the SED are extracted from SAX data in the 10 – 100 keV band (Turner et al. 2000), and XMM data in the 2 – 12 keV (Dewangan & Griffiths 2005). In the latter case, the reported absorption-corrected flux is used. An additional soft X-ray flux is extracted from the ASCA 0.25 - 2 keV band integrated flux, not corrected by absorption, reported by Cardamone, Moran & Kay (2007).

For comparison purposes, large aperture data in the mid- to far- IR are from IRAS (Sanders et al. 2003) are also included.

NGC 7582’s nucleus has shown variability in the optical, exhibiting broad emission lines. It is also variable in the X-rays by factors of to 2 in intensity on scales of months to years (Turner et al. 2000). There is no reported variability in the IR. On the basis of the mid-IR data used in this work, the inferred nuclear fluxes from TIMMI2 and VISIR observations collected four years are in excellent agreement.

An \( H-2.06 \) \( \mu \)m colour map is shown in Fig. 2. This is constructed from HST/NICMOS H-band and a VLT / NACO narrow band image at 2.06 \( \mu \)m. The central kpc region shown in the map reveals multiple star forming knots interlaced with dust. The average colour within a radius of 180 pc from the centre and outside the star forming knots is \( H-2.6 \) \( \mu \)m \( \sim \) 1.6. Further out, beyond 400 pc radius and avoiding the dust filaments, the average colour is \( H-2.02 \) \( \mu \)m \( \sim \) 0.9. The relative extinction towards the centre is estimated \( A_V \sim 9 \) mag (Table 2). The depth of the silicate feature at 9.6 \( \mu \)m points to larger values: \( A_V \sim 20 \) mag (Siebenmorgen et al. 2004).

\textit{NGC 1566}

NGC 1566 is a Seyfert type 1 nucleus at a distance of 20 Mpc (Sandage & Bedke 1994). Accordingly, the adopted scale is 1 arcsec \( \sim \) 96 pc. The HST/ WFPC2 images (e.g. Malkan, Gorjian & Tam 1998) show dust lanes circumscribing the nuclear region. Some of them can be followed up to the centre, where they seem to bend and spiral about. The near-IR VLT / NACO
diffraction-limited images reveal a smooth galaxy bulge but some of the innermost dust lanes still leave their mark even at 2 \( \mu m \). Both, at near- and mid-IR wavelengths, the nucleus is unresolved down to the best resolution achieved, FWHM < 0.12 arcsec in \( K \)-band (11 pc).

The SED is shown in Fig. 1. The high spatial resolution radio data are taken from ATCA observations at 8.4 GHz with a beam resolution FWHM = 1.29 \( \times \) 0.75 arcsecs (Morganti et al. 1999), and from PTI at 2.3 and 1.7 GHz with a beam resolution FWHM <0.1 arcsecs (Sadler et al 1995). In the mid-IR, the nuclear fluxes are extracted from VLT / VISIR diffraction-limited images at 11.9 and 18.7 \( \mu m \) (Reunanen et al. 2009). In the near-IR, those are extracted from VLT/NACO adaptive optics images in \( J \)-, \( K \)- and \( L \)-bands, within an aperture diameter of 0.4 arcsecs. UV fluxes, in the 1200 to 2100 \( \AA \) range, were directly measured on the re-calibrated pre-COSTAR \textit{HST}/FOS nuclear spectra published by Evans & Koratkar (2004). These fluxes were measured on the best possible line-free spectral windows. FOS spectra were collected with the circular 0.26 arcsec aperture diameter. Optical nuclear fluxes were extracted from \textit{HST}/WFPC2 images with the filters F160BW, F336W, F547M, F555W and F814W. The X-ray data are from \textit{BeppoSAX} in the 20 – 100 keV range (Landi et al. 2005), and from \textit{Einstein} in the 0.2 – 4 keV range (Fabbiano et al. 1992). In the latter case, an average of the two reported measurements is used. Large aperture data in the mid- and far-IR are from \textit{IRAS} (Sanders et al. 2003), the flux at 160 \( \mu m \) is from \textit{Spitzer} (Dale et al. 2007).

This nucleus may be variable by about 70\% in the X-rays (see Landi et al. 2005) but seems quieter in the optical and the near-IR. Variability by a factor of at most 1.3 over a 3 year monitoring period is reported in the near-IR, with the optical following a similar pattern (Glass 2004).

A VLT / NACO \( J-K \) colour map is presented in Fig. 2. On the basis of this map, the average colour in the surrounding of the nucleus is \( J-K \sim 1.5 \), the colours get bluer with increasing distance and at about 300 pc radius, the average colour in regions outside the dust filaments is \( J-K \sim 0.3 \). The comparison of both implies an extinction towards the nucleus of \( A_V \sim 7 \) mag (Table 2).

\textit{NGC 3783}

NGC 3783 is a Seyfert type 1 nucleus in a SBA galaxy. The adopted scale is 1 arcsec \sim 196 pc (redshift taken from NED). The optical \textit{HST} ACS images show a prominent nucleus surrounded by fingers of dust (also seen in the \textit{HST}/WFPC2 F606W image by Malkan et al, 1998), a bulge and a star forming ring at about 2.5 kpc radius from the centre. In the near-IR VLT /NACO images, the emission is dominated by an equally prominent nucleus within a smooth and symmetric bulge; the star forming ring just get outside the field of view of these images. An upper limit to the size of the nuclear region is FWHM < 0.08 arcsec (16 pc) at 2 \( \mu m \). First results with VLTI / MIDI interferometry with spatial resolutions \sim 40mas at 12 \( \mu m \) indicate a partially resolved nuclear region (Beckert et al. 2008). Modelling of these data with a clumpy dusty disk indicates a central
structure $\sim 14pc$ in diameter at 12 $\mu$m. This result requires further confirmation with different base-line configurations.

The SED is shown in Fig. 1. It includes VLA data at 8.4 GHz (FWHM $\leq 0.25$ arcsec, Schmit et al. 2001), at 4.8 GHz (FWHM $\sim 0.4$ arcsec, Ulvestad & Wilson, 1984) and at 1.4 GHz (FWHM $\sim 1$ arcsec$^2$, Unger et al. 1987). VLT / VISIR diffraction-limited data at 11.9 and 18.7 $\mu$m from Reunanen et al. (2009) cover the mid-IR range. In the near-IR, 1 to 4 $\mu$m, the nuclear fluxes are extracted from our VLT / NACO adaptive optics images in the J-, K- and L- bands using apertures of $\sim 0.4$ arcsec diameter. In the optical, nuclear-aperture photometry was extracted from archived HST ACS images taken with the filters F547M and F550M and the WFPC2 image with the filter F814W. The UV range is covered with archival HST /STIS spectra in the 1100–3200 Å region. Continuum fluxes were measured on best possible line-free regions. As NGC 3783’s nucleus is very strong, we decided in this case to supplement the SED with additional UV measurements from larger aperture data, specifically, from the FUSE spectrum published in Gabel et al. (2003) - we measured a data point at $\sim 1040$ Å on their estimated continuum flux level in their Fig 1 - in a $U$-band measurement in a 9.6 arcsec aperture from Las Campanas 0.6 m telescope reported in McAlary et al. (1983).

In the high energy range, nuclear fluxes at specific energies were extracted from observations with OSSE in the 50 – 150 keV range (Zdziarski, Poutanen & Johnson 2000), INTEGRAL in the 17 – 60 keV (Sazonov et al. 2007), XMM in the 2–10 keV range - in the later case, the reported flux from the summed spectrum of several observations in Yaqoob et al. (2005) was used - and Einstein, in the 0.2 -4 KeV (Fabbiano et al. 1992).

Large aperture data in the mid-to-far IR are from IRAS (Moshir et al. 1990).

NGC 3783 is known to be variable in the optical and the near-IR by factors of up to 2.5 in intensity on the scale of months (Glass et al. 2004); and on scales of minutes by a factor of 1.5 in the X-rays (Netzer et al. 2003).

A VLT / NACO J–K colour map of the central 1.5 kpc region is shown in Fig. 2. The nucleus is the most prominent feature, this appears surrounded by diffraction rings and atmospheric speckles. The colour distribution is rather flat across the galaxy: J - K $\sim < 1$. The inferred extinction towards the nucleus is moderate: $A_V < 0.5$ mag. In the VLTI / MIDI interferometric spectrum the silicate feature at 9.6 $\mu$m is absent (Beckert et al. 2008).

**NGC 7469**

This type 1 nucleus is the most distant source in the sample, 20 times further than Cen A. The adopted scale is 1 arcsec $\sim 330$ pc (from the redshift taken from NED). The nucleus is surrounded by a starforming ring that extends from 150 pc to about 500 pc radius (as seen in the HST /ACS UV image in Munoz-Marín et al. 2007). The nucleus is unresolved at near-IR wavelengths down to
best resolution achieved with VLT / NACO adaptive optic images. That was in the H-band, from which an upper limit to the nucleus size FWHM < 0.08 arcsec (26 pc) is derived.

The SED for this source is shown in Fig. 1. This nucleus is known to have undergone an high state level in the optical - UV in the period 1996 – 2000, followed by a slower return to a low state level reaching a minimum at 2004. Changes in the continuum intensity up to a factor of 4 were measured (Scott et al. 2005). The nucleus is also variable in the X-rays by a factor of 2.5 (Shinozaki et al. 2006). On the other hand, monitoring of the source with IRAS pointed observations in 1983 in a time period of 22 days indicates a stable source at the 5% level (Edelson & Malkan 1987). Accordingly, special attention was paid in selecting data the most contemporaneous possible, with most of them being taken from the year 2000 on. Thus, the SED is based on the following data sources.

The radio regime is covered with PTI data at 1.7 and 2.3 GHz, with beam size of ~ 0.1arcsec (Sadler et al. 1995), MERLIN data at 5 GHz, with beam size of < 0.05arcsec (Alberdi et al. 2007) and VLA archived data at 8.4 and 14 GHz, reanalysed in Orienti & Prieto (2009), and for which resolution beams of < 0.3 arcsec and < 0.14 arcsec respectively are obtained.

In the IR, nuclear fluxes were extracted from VLT / VISIR diffraction-limited images at 11.9 and 18.7 µm collected in 2006 (Reunanen et al. 2009), VLT/ NACO adaptive optics images in J-, H-, K- and L-bands and the narrow-band continuum filter at 4.05 µm, all collected from 2002 on (Table 12), and the HST / NICMOS narrow-band continuum image at 1.87 µm, collected in 2007.

In the optical and UV, the nuclear fluxes were extracted from the HST /ACS F330W (collected in 2002), F550M and F814W (both in 2006), and WFPC2 F218W (1999) and F547M (2000) images. The aperture size used in all cases, VLT-IR and HST-optical-UV, was 0.6 arcsec in diameter. This selection was a compromise between getting most of the light in the nuclear PSF wing and avoiding the star forming ring.

In the X-rays, nuclear fluxes at specific energies were extracted from observations with INTEGRAL in the 17 - 60 keV band (Sazonov et al. 2007), XMM in the 2-10 keV band (Shinozaki et al. 2006) and ROSAT in the 0.1 - 2.4 keV band (Perez-Olea & Colina 1996). In the case of XMM and ROSAT, the fluxes included in the SED were derived from the luminosities provided by the authors, and we thus assume they are intrinsic to the source, although this is not explicitly mentioned to be the case. The ROSAT flux is nevertheless not genuine from the nucleus as it includes the contribution of the complete star forming ring.

The SED is complemented with large aperture data in the IR, taken from IRAS (Sanders et al. 2003) and Spitzer (Weedman et al. 2005), and millimetre from SCUBA (Dunne et al. 2000) and the Caltech Submillimeter Observatory (Yang & Phillips 2007).

A VLT / NACO J–H colour map of the central 4 kpc region is shown in Fig. 2. This was
selected instead of the usual $J-K$ because of the better spatial resolution reached in the H-band. The map shows the nucleus and a ring of diffuse emission which just encloses the star forming regions, with radius of 500 pc. Further out from the ring, the signal in the individual near IR images drops dramatically, and a reliable estimate of the intrinsic galaxy colours is not possible. Thus, an estimate of the relative extinction around the nucleus is not provided in this case. As in NGC 3783, the available VLTI/MIDI interferometric spectra do not show evidence for a silicate feature.

4. Comparing with a Quasar: the SED of 3C 273

3C 273 is one of the most luminous quasars in the sky reaching a luminosity of several $10^{46}$ erg sec$^{-1}$ at almost any energy band. In gamma-rays, its luminosity reaches $10^{47}$ erg sec$^{-1}$, which is suspected to be due to strong beaming at these energies.

3C 273 is a radio loud source while all the other AGN discussed in this work are radio quiet, with the possible exception of Cen A. It is also the most distant object in the sample: the adopted scale is 1 arcsec $\sim$ 3.2 kpc (redshift taken from NED). The high power of 3C 273 makes its SED insensitive to the spatial resolution data used at almost any band, except in the low frequency regime where some of the jet components are somewhat comparable to the core strength. That together with its excellent wavelength coverage lead us to use this SED as a reference for a no obscured AGN. 3C 273 is variable mainly at high energies by factors of 3 to 4. But from optical to radio, the reported variability is 20 to 40\% (Lichti et al. 1995; Turler et al. 1999), which might affect the SED in detail but has minimal impact on the overall shape. The SED of 3C 273 is shown in Fig. 1. The data from 1 $\mu$m up to the gamma-rays are from Turler et al. (1999). These data are indeed an average of multiple observations at distinct epochs. Further in wavelength, the following set of data are used: for consistency with the rest of the work presented here, the data beyond 1 $\mu$m up to 5 $\mu$m are taken from our VLT/NACO adaptive optics images (collected in May 2003); the difference with the larger aperture data used in Turler et al. is less than 10\%. The 6 to 200 $\mu$m range is covered with ISO (collected in 1996, Haas et al, 2003). In the millimetre and radio waves we used higher resolution data than that in Turler et al. to better isolate the core from the jet components. Those are: VLBI observations at 3 mm from Lonsdale, Shepher & Robert (1998) and 147, 86, 15 and 5 GHz from Greve et al. (2002), Lobanov et al. (2000), Kellerman et al. (1998) and Shen et al. (1998) respectively. Additional VLBA measurements at 42 and 22 GHz - peak values - are taken from Marscher et al. (2002).

A VLT/NACO $J-K$ colour map is shown in Fig. 2. This just shows the central point-like source and various diffraction rings.

The SED of 3C 273 differs from all those shown in this work in the radio domain mainly, presenting a flatter spectrum as expected from a radio loud source. In the optical to UV, the difference is also important with type 2 nuclei because of the dust absorption in the latter but less
so with type 1s. For comparative purposes, an artificial extinction of $A_V = 15$ mag was applied to the SED of 3C 273 and the result is shown on top of its SED in Fig. 1. With extinction values in this range, which is on average what we measure from the near-IR colour maps in the galaxy sample, the UV to optical region in 3C 273 becomes fully absorbed, presenting a closer resemblance with that shown by the Seyfert type 2 nuclei.

The comparison of 3C 273 with the type 1 nuclei is more illustrative. The average of the three genuine type 1 SEDs compiled in this work is shown together with that of 3C 273 in Fig. 3. The SEDs are normalised to the mean value of their respective power distributions, in this way they appear at comparable scale about the optical region. All the SEDs show in the optical to UV the characteristic blue bump feature of type 1 sources and the usual inflexion point at about 1 $\mu$m. However, whereas the blue bump is stronger in 3C 273, indeed the dominant feature in the UV to IR region, that is weaker and softer in energy in the Seyfert 1’s. Conversely, in the IR the type 1 objects show a broad bump feature in the 10 - 20 $\mu$m range whereas 3C 273 shows a flatter distribution over the same spectral region, the general trend being of a shallow decrease in power with decreasing frequency.

A weaker UV bump is an indication of more dust in the line of sight to these type 1 nuclei, but the lack of the IR bump in 3C 273, which is a key diagnostic of the existence of a central obscuring dust structure in any AGN, points to no much dust in this nucleus. This absence may still be due to a strong non-thermal contribution - this is a flat-spectrum radio source - which would smear out any IR bump. However, this will make the dust contribution to the IR even lower. Some hot dust may still exists in 3C 273, as traced by the detection of silicate features in emission at 10 and 20 $\mu$m (Hao et al. 2005). Thus, the overall evidence points to a poor dusty environment in this object as compared with those of lower luminosity AGN. There are also first results with VLTI / MIDI and Keck interferometry on 3C 273 which indicate a slightly resolved nuclear structure at 10 and 2 $\mu$m respectively (Tristram et al. 2009 and Pott 2009). However it is more plausible that this structure is caused by the jet of 3C 273 rather than by dust.

At the high energies, the comparison of the Seyfert’s SED shape with that of 3C 273 is limited by the poorer spectral coverage of the former. Still, in the overlapping region, from the soft X-rays till $\sim$200 keV, the SED of all the Seyfert’s present a gentle rise in power with increasing frequency. This trend may point out to the existence of a further emission bump at much higher energies but that may escape detection with present facilities. A broad emission bump peaking at the MeV region is detected in both 3C 273 and Cen A, both with jets detected in the X-rays.
SED of nearby galaxy cores

Fig. 3.— Average SED - in red - of the type 1 nuclei in this work: NGC 1566, NGC 3783 and NGC 7469. 3C 273 - in yellow - is shown for comparison. Prior averaging, each SED was set to its rest frame system and then normalised to the mean value of its $\nu F_\nu$ distribution. In the X-rays, the average is determined in the common to the three objects energy-window, 1 to $\sim 60$ keV.
5. Results: the new SED of nearby AGN

5.1. The SED shape

The high spatial resolution SEDs (Fig. 1) are all characterised by two main features: a emission bump in the IR and an increasing trend in power at the high energies.

The available high spatial resolution data spans the UV, optical, and IR up to about 20 µm. Shortward of ~ 1µm, all the type 2 nuclei are undetected, or barely detected (e.g NGC 7582). Longward of 20 µm, there is a wide data gap up to the radio frequencies due to the lack of data of comparable spatial resolution. Subject to these limitations, all type 2 nuclei are characterised by a sharp decay in power from 2 µm onwards to the optical wavelengths. Conversely, type 1 objects present also a decay shortward of 2 µm but this recovers at about 1 µm to give rise to the characteristic blue bump feature seen in Quasars and type 1 sources in general (e.g. Elvis et al. 1994). The inflexion point at about 1µm is also a well known feature in AGN, generally ascribed to a signature of dust emission at its limiting sublimation temperature (Sanders et al. 1989). The only LINER in the sample, NGC 1097, appears as an intermediate case between both type 1 and 2: it is detected up to the UV wavelengths but there is no blue bump, its overall SED being more reminiscent of a type 2 nucleus.

Longward of 2 µm all the SEDs tend to flat and there is some hint of a turnover towards lower power at about 20 µm in some objects. The large data gap in the far-IR to the millimetric wavelengths leaves us with the ambiguity on the exact shape of the IR bump and its width. Because of the small physical region sampled in the near- to mid- IR, on the scale of tens of parsec, an important contribution from cold dust at these radii that would produce a secondary IR-millimetre bump is not anticipated. Instead, a smooth decrease in νFν towards the radio frequencies is expected. This suggestion follows from the SED turnover beyond 20 µm shown by the objects for which large aperture data in the far-IR or the millimetre wavelengths could be included in their SEDs, namely NGC 3783, NGC 5506 and Cen A.

The complete galaxy sample is detected in the 0.2 –100 keV region - with the exception of NGC 1097 for which no reported observations beyond 10 keV were found. All show a general increase in power with frequency. At higher energies, Cen A is the only source detected up to the MeV region. Indeed, among low-power AGN, Cen A is so far the only source detected at gamma-rays (Schonfelder et al. 2000). 3C 273 is of course detected at these energies and as Cen A, both exhibit a rather broad bump peaking in the MeV region.

Fig. 4 shows the average of the type 2 SEDs - excluding the case of Cen A because of its non-thermal nature, see sect. 7 - compared with that of the type 1’s (same average SED shown in Fig. 3). The same procedure to produce the average type 1’s is used for type 2’s: each type 2 SED is normalised to the mean of its power distribution, the resulting SEDs being then averaged. The resulting average template for each type are plotted one on top of the other in the figure. It can be seen that the most relevant feature in both SED types is the IR bump. This can be reconciled with
emission from dust with an equivalent grey-body temperature of \( \sim 300 \) K in average (section 5.2).

The location and shape of the bump longward of 2 \( \mu m \) is similar for both types; it is shortward of this wavelength where the difference arises: type 1s present a shallower 2 \( \mu m \)-to-optical spectrum which is further ensued by the blue bump emission. This dramatic difference suggests a clearer sight line to hot dust in type 1s but and obscured one in type 2s. This is fully consistent with the torus model: the shallower spectrum reflects the contribution of much hotter dust from the inner region of the torus which we are able to see directly in type 1s; in the type 2s this innermost region is still fully absorbed by enshrouding colder dust.

The second important feature in both SED templates is the high energy spectrum. Within the common sampled energy band – 0.1 to \( \sim 100 \) keV – this region appears rather similar in both AGN types, the general trend being that of a gentle increase in power with increasing frequency.

### 5.2. Core luminosities

Having compiled a more genuine SED for these AGN, a tighter estimate of their true energy output can be derived by integrating the SED. This is done over the two main features in the SED: the IR bump and the high-energy spectrum (Fig. 1). For the type 1 sources, a further integration was done over the blue bump. The estimated energies associated with each of these regions are listed in Table 1. The procedure used is as follows.

The integration over the IR bump extends from the inflection point at about 1 \( \mu m \) in type 1s, from the optical upper limit in type 2s, up to the radio frequencies. Direct numerical integration on the \( F_\nu \) vs \( \nu \) plane was done. For those sources whose nuclear flux is independent on the aperture size, namely, NGC 5506, NGC 3783 and 3C 273, the integration includes the large aperture IR data as well. For Cen A, the millimetre data were also included. For all other sources, a linear interpolation between 20 \( \mu m \) and the first radio frequency point was applied. Effectively, the proposed integration is equivalent to integrating over the 1 – 20 \( \mu m \) range only as this region dominates the total energy output by orders of magnitude in all the objects. As a control, a modified black body (BB) spectrum, \( B_\nu \times \nu^{1.6} \), was fitted to this spectral range. The derived effective temperature converges into the 200 - 400 K range in most cases, and the inferred IR luminosities are of the same order of magnitude as those derived by the integration procedure over the SED. Focussing on the objects for which their nuclear fluxes are independent on the aperture size – NGC 3783 and NGC 5506 – a further test was done by comparing their integrated luminosity in the 1 – 20 \( \mu m \) range with that in the 1 – 100 \( \mu m \) range, the latter including all the available data. The 1 – 20 \( \mu m \) luminosity is found about a factor of 1.5 smaller. Thus, the IR luminosity is probably underestimated by at least this factor in all other sources.

At high energies, due to energy-band overlapping between different satellites, a direct integration over the SED was avoided. Instead, we used X-ray luminosities reported in the literature,
Fig. 4.— Average SED template of type 1s, in thick line - includes NGC 3783, NGC 1566 and NGC 7469 - and of type 2s, dash line - Circinus, NGC 1068, NGC 5506 and NGC 7582. Before averaging, each SED was set to its rest frame system and then normalised to the mean value of its $\nu F_\nu$ distribution. The average for type 2s in the X-rays is determined in the common energy window, 1 to 70 keV, that of type 1s in the energy window 1 to 60 keV.
selecting those derived from the hardest possible energy band, usually in the 20 – 100 keV range. X-ray luminosities above 20 keV are less subjected to absorption and thus expected to be a fair indication of the nuclear budget (with the possible exception of NGC 1068 due to the large X-ray column density, $N(H) > 10^{25} \text{cm}^{-2}$, inferred in this case, Matt et al. 1997).

For the Seyfert type 1 nuclei, the integration over the blue bump spans the 0.1 to 1 $\mu$m region. The same integration procedures described above were applied to 3C 273 as well.

On the basis of these energy budgets, an estimate of the bolometric luminosity in these AGNs is taken as the sum of the IR plus X-ray - above 20 keV - luminosities (Table 1). In doing so, it is implicitly assumed that the IR emission is a genuine measurement of the AGN energy output and accounts for most of the optical to UV to X-ray luminosity generated in the accretion disk.

6. The extinction gradient towards the centre

Table 2 gives a comparison of nuclear extinction values inferred from different methods. A first order estimate is derived from the near-IR colour maps presented in this work. With these maps, the colours in the surrounding of the nucleus are compared with those at further galactocentric radii, usually at several hundred parsecs. Colour excesses are found to progressively increase towards the central region, an indication of an increasing dust density towards the nucleus. In some cases however the distribution of colours is rather flat, e.g. in NGC 1097, NGC 3783. These central extinctions, in some cases inferred at distances of 30 - 50 pc from the centre, are systematically lower, by factors of 2 - 3, than those inferred from the silicate feature at 9.6 $\mu$m (Table 2). Considering the very high spatial resolution of some of the silicate feature measurements, the difference is an indication that the distribution of absorbers at the nuclear region is not smooth but has a high peak concentration at the very centre.

A further comparison with the optical extinction inferred from the X-rays column density, assuming the standard Galactic dust-to-gas ratio and extinction curve (Bohlin et al. 1978), is also given in Table 2. It is known that the extinctions derived this way are always very large. For the objects in this work, they are several factors, or even orders of magnitude in the Compton thick cases, higher than those inferred from the silicate feature. Only in NGC 5506, the values derived from both methods agree. Such high discrepancies have to be due to the inapplicability of the Galactic dust-to-gas ratio conversion in AGN environments (see Gaskell et al. 2004).

7. Discussion

The IR SED: large aperture vs high spatial resolution
We have compiled spectral energy distributions at subarcsec scales for a sample of nearby well known AGN. These SEDs reveal major differences in the IR region when compared with those based on IR satellite data. First, the trend defined by the large aperture IR data (crosses in fig. 1) is different from that defined by the high spatial resolution data (filled points in fig. 1). Second, the true AGN fluxes can be up to an order of magnitude lower than those inferred from large aperture data, hence the bolometric luminosities based on IR satellites data can be overestimated by orders of magnitude.

The number of objects studied at these high spatial resolutions is small. They are however among the nearest AGN. Subjected to this limitation, if we take the new SEDs as a reference for the Seyfert class, the above results have two further implications:

1) the AGN contribution to the mid-to-far IR emission measured by e.g. *IRAS*, *ISO*, *Spitzer* is minor, the bulk of the emission measured by these satellites comes from the host galaxy. This result fully confirms previous work by Ward et al. (1987), who pointed out the relevance of the host galaxy light in the IRAS fluxes in already type 1 AGNs. On this basis it is understandable the radio – far-IR correlation followed by AGN and normal star forming galaxies alike (Sopp & Alexander 1991; Roy et al. 1998; Polleta et al. 2007). A common trend indicates that the far-IR emission is unrelated to the AGN. The shape of the high spatial resolution SEDs of the sample AGN shows that the large aperture mid-IR is also unrelated in most cases.

2) the selection or discrimination of AGN populations on the basis of mid to far IR colours may not be applicable on a general basis. For example, Grijp’s et al. (1987) criteria based on the IRAS density flux ratio at 60 and 25 µm, $f_{60}/f_{25} > 0.2$, to find predominantly AGN. Recently, Sanders et al (2007) proposes the use the colour of the Spitzer 3.6 to 24 µm spectrum to help separating type 1- from type 2- AGN. Considering the shape and luminosity of the high spatial resolution SEDs, it is somewhat surprising that large aperture mid-to-far IR colours may keep track of the existence of a central AGN in most galaxies.

However, the above criteria should apply to cases where the AGN dominates the IR galaxy light in a similar way as in quasars. Two of the high spatial resolution SEDs studied reflect this situation: NGC 5506, a type 2- , and NGC 3783, a type 1- nucleus. In both, large aperture data remain genuine of the nuclear emission, as it is also the case of the quasar 3C 273 used here for comparative purposes. The SEDs of these objects show a smooth connection between the large aperture far- to mid- IR data and the high spatial resolution mid- to near- IR data (Fig. 1). In NGC 5506, the nucleus's high contrast in the IR is due to the low surface brightness and edge-on morphology of the host galaxy. However, this is not the case for NGC 3783 which resides in a bright face-on spiral. 3C 273 resides in an elliptical galaxy but as an extreme powerful quasar it dominates the light of its host at any wavelength. The relevance of the AGN in these objects is more obvious in the $J–K$ colour maps shown in Fig. 2. These are dominated by the central source, and almost no trace of the host galaxy at further radii from the centre are detected indicating a
flat and smooth galaxy light profile. This morphology is rather different from what is seen in the other AGN in the sample whose colour maps highlight the central dust distribution.

NGC 5506 and NGC 3783 happen to be among the most powerful nuclei in the sample, besides 3C 273, with IR luminosities above $10^{44}$ erg s$^{-1}$. The nearest in power is NGC 1068 with LIR $\sim 8.6 \times 10^{43}$ erg s$^{-1}$ (Table 1), a mere factor of 2 lower. Thus, there is a tentative indication that AGN luminosities above $10^{44}$ erg s$^{-1}$ may easily be traceable in the IR regardless of the aperture flux used. One would expect quasars to naturally comply with this criterion but the generalisation is not that obvious. A third AGN in the sample, NGC 7469, has an IR core luminosity of $2 \times 10^{44}$ erg s$^{-1}$, but its host galaxy dominates the total IR budget by a factor of seven (Table 1).

**Total energy budget: IR vs X-ray luminosities**

The derived nuclear luminosities in the IR should provide a tighter quantification of the dust-reprocessed optical to UV and X-rays photons produced by the AGN - the accretion luminosity and X-ray corona. On that premise, an estimate of the total energy budget in these objects as the sum of their IR and hard X-ray emissions is evaluated ($L_{IR} + L_{>20keV}$ in Table 1). We compute the same number in type 1s as well, on the assumption that the blue-bump emission visible in these objects is accounted for in the IR reprocessed emission and thus is not summed up to the total budget (following similar reasoning as in e.g Vasudevan & Fabian, 2007). We account for the X-ray contribution for energies above 20 keV as photons beyond this energy should provide a genuine representation of the nucleus plus jet emission.

In comparing the IR and X-ray luminosities in Table 1, the IR luminosity is found to dominate the total budget, by more than $\sim 70\%$ in seven out of the ten cases studied. Indeed, in most of these cases, the X-ray emission is a few percent of the total. The three exceptions include Cen A, in the border line with an IR contribution about 60% of the total, and 3C 273 and NGC 1566, where the IR contribution reduces to less than 30% of the total. Cen A and 3C 273 are the two sources in the sample with a strong jet, also in the X-rays.

As it can be explored from the table 1, there is not dependance of the IR to X-ray ratio on the AGN luminosity but the sample is small. This ratio is furthermore vulnerable to variability. As reported for each object in sect. 3, variability in the X-rays is common in these objects, by a factor of 2 to 3 in average - up to a factor of 10 has been seen in Cen A - whereas variability in the IR is at most a factor of 2, so far only known for Cen A, NGC 1068 and NGC 3783. Thus, X-ray variability which is also faster in time scales, can modify the IR to X-ray ratios up and down by the same factors. Still, even if accounting for a positive increase in the X-ray luminosity by these factors, the IR luminosity remains the dominant energy output for most cases. Just a factor of 2 decrease in the X-rays in the three objects with a reduced IR core, Cen A, 3C 273 and NGC 1566, will place their X-ray and IR luminosities to the same level.
Focusing on the Seyfert type 1 objects, all characterised by a blue bump component in the SED, the luminosity associated with the observable part of this region is \( \sim 15\% \) of the IR luminosity, whereas in 3C 273, integrating over the same spectral region, that is \( 90\% \) (Table 1). A fraction of the blue bump energy is unobserved as it falls in the extreme UV to soft-Xrays data gap, still, the fact that there is almost a factor six difference in these relative emissions between 3C 273 and the Seyfert type 1 nuclei is an indication that Seyfert AGN are seen through much more dust. This is in line with conclusions reached by Gaskell et al. (2004) who argue on the presence of additional reddening by dust in radio-quiet as compared with radio-loud AGNs. If this is the case, the IR bump luminosity may be one of the most tight measurements of the accretion luminosity in Seyfert galaxies.

**Centaurus A: a special case**

Among all AGN analysed in this work Centaurus A’s SED singles out as a particular case. The data points from VLBA over the millimetre to the high resolution IR measurements follow a rather continuous trend. This region can be fitted by a simple synchrotron model with spectral index, \( F_\nu \sim \nu^{-0.3} \), and still the \( \gamma \)-ray emission be explained as inverse Compton scattering of the radio synchrotron electrons (Prieto et al. 2007, see also Chiaberge et al. 2001). Such a flat synchrotron spectrum has been suggested by Beckert & Duschl (1997 and references therein) for low luminosity AGN, among which Cen A nucleus can be considered. The available high spatial resolution IR observations indicate that most of the emission comes from a very compact source less than 1 pc in diameter (Meisenheimer et al. 2007). This together with the apparent synchrotron nature of its SED points to a rather torus-free nucleus. Cen A is one of the lowest power sources in the sample, with \( L(IR) \sim 10^{42} \) erg s\(^{-1}\). On theoretical grounds, it is being argued that AGNs of this low power may be unable to support a torus structure and should thus show a bare nucleus at IR wavelengths (e.g. Hoenig & Beckert 2007; Elitzur & Shlosman 2006). In other respects, Cen A’s SED is similar to those of type 2 nuclei in this study, in the sense that its optical to UV is totally obscured but this may be caused by the large scale dust lanes crossing in front of its nucleus. The future availability of millimetre data of high spatial resolution will help to confirm the nature of this SED.

8. Conclusions

Sub-arcsec resolution data spanning the UV, optical, IR and radio have been used to construct spectral energy distributions of the central, several tens of parsec, region of some of the nearest and brightest active galactic nuclei. Most of these objects are Seyfert galaxies.

These high spatial resolution SEDs differ largely from those derived from large aperture data,
in particular in the IR: the shape of the SED is different and the true AGN luminosity can get overestimated by orders of magnitude if based on IR satellite data. These differences appear to be critical for AGN luminosities below $10^{44}\text{erg s}^{-1}$ in which case large aperture data sample in full the host galaxy light. Above that limit we find cases among these nearby Seyfert galaxies where the AGN behaves as the most powerful quasars, dominating the host galaxy light regardless of the integration aperture-size used.

The high spatial resolution SED of these nearby AGNs are all characterised by two major features in their power distribution: an IR bump with maximum in the 2 -10 $\mu$m range, and an increasing trend in X-ray power with frequency in the 1 to $\sim$ 200 keV region, i.e. up to the hardest energy that was possible to sample. These dominant features are common to Seyfert type 1 and 2 objects alike.

The major difference between type 1 and 2 in these SEDs arises shortward of 2 $\mu$m. Type 2s are characterised by a sharp fall-off shortward of this wavelength, with no optical counterpart to the IR nucleus being detected beyond 1 to 0.8 $\mu$m. Type 1s show also a drop shortward of 2 $\mu$m but this is more gentle - the spectrum is flatter - and recovers at about 1 $\mu$m to give rise to the characteristic blue-bump feature seen in quasars. The flattening of the spectrum shortward of 2 $\mu$m is also an expected feature of type 1 AGNs. Interpreting the IR bump as AGN reprocessed emission by the nuclear dust, in type 1s the nearest to the centre hotter dust can be directly seen, hence the flattening of their spectrum, whereas in type 2s this hot dust is still fully obscured.

Longward of 2 $\mu$m, all the AGN types show very similar SEDs, the bulk of the IR emission starts from this wavelength on and the shape of the IR bump is very similar in all the AGNs. This is compatible with an equivalent black-body temperature for the bulk of the dust in the 200 - 400 K range in average. Although the current shape of the IR bump is limited by the availability of high angular resolution data beyond 20 $\mu$m for most objects, due to the small region sampled in these SEDs, of just a few parsecs in some galaxies, a major contribution from colder dust that will modify the IR bump is not expected.

It can thus be concluded that at the scales of a few tens of parsec from the central engine, the bulk of the IR emission in either AGN type can be reconciled with pure dust emission. It follows that further contributions from a non-thermal synchrotron component and/or a thermal free-free emission linked to cooling of ionised gas are insufficient to overcome that of dust at these physical scales. The detailed modelling of NGC 1068's SED - this being one of the most complete we have compiled - in which these three contributions – synchrotron, free-free and a dust torus components - are taking into account illustrates that premise, that is, the dominance of dust emission in the IR, even at the parsec-scale resolution achieved for this object in the mid-IR with interferometry
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(Hoenig et al. 2008). Only the two more extreme objects in this analysis, Cen A, on the low luminosity rank, and 3C 273, on the highest, present a SED that is not dominated by dust but by a synchrotron component. We tend to believe that is due to a much reduced dust content in these nuclei.

Over the nine orders of magnitude in frequency covered by these SEDs, the power stored in the IR bump is by far the most energetic fraction of the total energy budget measured in these objects. Evaluating this total budget as the sum of the IR and hard X-ray – above 20 keV – luminosities, the IR part accounts for more than 70% of the this total in seven out of the ten AGN studied. In the three exceptions, the IR fraction reduces to ≲ 30% (3C 273 and NGC 1566), ≲ 60% in Cen A. Even if accounting for variability in the X-rays, by a factor 2 to 3 in average, the IR emission remains in all cases dominant over, or as important as, in the last three cases, the X-ray emission. If comparing with the observed blue bump luminosity in the type 1 nuclei, this represents less than 15% of the IR emission. Putting all together, the IR bump energy from these high spatial resolutions SEDs may represent the tightest measurement of the accretion luminosity in these Seyfert AGN.

The average high spatial resolution SED of the type 2 and of the type 1 nuclei analysed in this work, and presented in Fig. 4, can be retrieved from http://www.iac.es/project/parsec/main/seyfert-SED-template.

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Table 1. Energy budget in nearby AGN. Objects ordered by increasing IR core luminosity

| Name          | AGN type | FWHM$\text{_{nucleus}}$ in pc at 2 $\mu$m | $L_{\text{IR-HSR}}$ erg/s | $L_{\text{X}>20\text{keV}}$ erg/s | $L_{\text{total}}$ erg/s | $\frac{L_{\text{opt-UV}}}{L_{\text{IR-HSR}}}$ % | $\frac{L_{\text{IR-HSR}}}{L_{\text{total}}}$ % | $\frac{L_{\text{IRAS}}}{L_{\text{IR-HSR}}}$ | LIRAS erg/s |
|---------------|----------|------------------------------------------|---------------------------|---------------------------------|-------------------------|---------------------------------|---------------------------------|-----------------|-------------|
| NGC 1097/ L1  |          | <11                                      | 3.3x10$^{41}$             | 5.2x10$^{40}$                  | 3.8x10$^{41}$           | -                               | 87                              | 500              | 1.5x10$^{44}$ |
| Cen A / T2    |          | <1                                       | 1.7x10$^{42}$             | 1.1x10$^{42}$                  | 2.8x10$^{42}$           | -                               | 61                              | 20               | 3.5x10$^{43}$ |
| NGC 1566/ T1  |          | <11                                      | 1.8x10$^{42}$             | 3.7x10$^{42}$                  | 5.5x10$^{42}$           | 14                              | 33                              | 78               | 1.4x10$^{44}$ |
| Circinus / T2 |          | ∼2                                       | 8x 10$^{42}$              | 4.3x10$^{41}$                  | 8.4x10$^{42}$           | -                               | 82                              | 7                | 5.5x10$^{43}$ |
| NGC 7582/ T2  |          | < 11                                     | 1.3x10$^{43}$             | 4.5x10$^{42}$                  | 1.8x10$^{43}$           | -                               | 72                              | 25               | 3.2x10$^{44}$ |
| NGC 1068/ T2  |          | 1.2 x2.8                                 | 8.6 x10$^{44}$            | 6.5 x10$^{41}$                | 8.7 x10$^{43}$         | -                               | 99                              | 9                | 7.8 x10$^{44}$ |
| NGC 5506/ T2  |          | <13                                      | 1.2x10$^{44}$             | 6.6x10$^{42}$                  | 1.3x10$^{44}$           | -                               | 99                              | 1.1              | 1.3 x10$^{44}$ |
| NGC 3783/ T1  |          | <16                                      | 1.6x10$^{44}$             | 2.5x10$^{43}$                  | 1.8x10$^{44}$           | 13                              | 89                              | 0.8              | 1.3 x10$^{44}$ |
| NGC 7469/ T1  |          | < 26                                     | 2.2 x10$^{44}$            | 3 x10$^{43}$                   | 2.5 x10$^{44}$         | 10                              | 88                              | 7                | 1.5 x10$^{45}$ |
| 3C 273/ T1    |          | <270                                     | 2.4 x10$^{46}$            | 5.7 x 10$^{46}$               | 8 x 10$^{46}$          | 90                              | 30                              | 0.8              | 1.9 x10$^{46}$ |

Column 1: Object name and AGN type: type 1, 2 and LINER.
Column 2: upper limit to the core size at 2 $\mu$m, set by the spatial resolution achieved in the K-band adaptive optics image. Only in Circinus and NGC 1068 x is resolved at 2 $\mu$m, the quoted sizes are from Prieto et al. 2004 and Weigelt et al. 2004 respectively.
Column 3: IR luminosity integrated over the high spatial resolution (HSR) data, from radio to the inflexion point in the optical. It includes IRAS and/or ISO data only in the cases of NGC 3783, NGC 5506 and 3C 273 only (see text for details).
Column 4: X-ray luminosity from the highest energy range available in the literature. These are as follows: L(20 –100 keV) for Cen A, Circinus, NGC 1068 and NGC 5506 (Beckmann et al. 2006), and for NGC 7582 and NGC 1566 (Landi et al. 2005); L(2 –10 keV) for NGC 1097 (Terashima et al. 2002); L(17–60 keV) for NGC 3783 and NGC 7469(Sazonov et al. 2007); L(20 – 200 KeV) for 3C 273, average of two measurements at different epochs (Lichti et al. 1995). All the luminosities are normalised to $H_0 = 70$ km s$^{-1}$ Mpc$^{-1}$ when required or to the adopted distance for the nearest objects, namely Cen A, Circinus, NGC 1068, NGC 1097 and NGC 1566 (see object’s section).
Column 5: total luminosity defined as $L_{\text{IR-HSR}} + L_{\text{X}(>20\text{keV})}$. Column 6: optical-UV luminosity -blue bump- relative to $L_{\text{IR-HSR}}$.
Column 7: IR fraction of the total luminosity. In columns 8 and 9, $L_{\text{IRAS}}$ is the IRAS luminosity following Sanders & Mirabel’s prescription (1996), and effectively accounts for the 8 - 1000 $\mu$m region.
Table 2. Extinction towards the nucleus: comparative

| Name      | $A_V$ (J - K) | $A_V$ (9.6 µm) | $A_V$ ($N_H$) |
|-----------|---------------|----------------|---------------|
| Type 2    |               |                |               |
| Cen A     | 5             | 14             | 62            |
| Circinus  | 6             | 21             | Compton-thick |
| NGC 1068  | 10-12         | 7 - 30         | Compton-thick |
| NGC 7582  | 9             | 20             | >70           |
| NGC 5506  | 5             | 15             | 17            |
| LINER     |               |                |               |
| NGC 1097  | 1             | -              | -             |
| Type 1    |               |                |               |
| NGC 1566  | 7             | -              | -             |
| NGC 3783  | <~ 0.5        | -              | -             |
| NGC 7469  | -             | -              | -             |
| 3C 273    | -             | -              | -             |

$A_V$ derived from $J - K$ maps: nuclear extinction relative to that in the galaxy within the central kpc region (see text); $A_V$ from the optical depth at the Silicate 9.6 µm feature is derived from MIDI spectra in Cen A (Meisenheimer et al. 2007), Circinus (Tristram et al. 2007), and NGC 1068 (Raban et al. 2009); from TIMMI2 spectra in NGC 5506 and NGC 7582 (Siebenmorgen et al. 2004). In NGC 3783 no silicate feature in the interferometric MIDI spectrum is apparent (Beckert et al. 2008). No report on the silicate optical depth was found for the remaining sources. The standard dust-to-gas ratio is applied to infer the extinction from the X-ray $N(H)$. For those with no entry, the Galaxy $N(H)$ is assumed in their X-ray fit. References to $N(H)$ are in the caption to table 1.
Table 3. SED of Centaurus A core region

| Origin                  | Hz          | Jy            |
|-------------------------|-------------|---------------|
| COMPTEL 5.1 MeV         | $1.25 \times 10^{21}$ | $1.78 \times 10^{-8}$ |
| COMPTEL 1.7 MeV         | $3.98 \times 10^{20}$ | $1.0 \times 10^{-7}$ |
| COMPTEL 0.86 MeV        | $2.09 \times 10^{20}$ | $3.75 \times 10^{-7}$ |
| INTEGRAL 20-100 keV    | $1.45 \times 10^{19}$ | $2.4 \times 10^{-6}$ |
| INTEGRAL 2-10 keV      | $2.42 \times 10^{18}$ | $8.8 \times 10^{-6}$ |
| CHANDRA 1 keV          | $2.42 \times 10^{17}$ | $6.2 \times 10^{-5}$ |
| WFPC2-F555W            | $5.40 \times 10^{14}$ | $< 6.4 \times 10^{-8}$ |
| WFPC2-F814W            | $3.68 \times 10^{14}$ | $7.0 \times 10^{-6}$ |
| NACO-J                 | $2.30 \times 10^{14}$ | 0.0013 |
| NACO-H                 | $1.76 \times 10^{14}$ | 0.0045 |
| NACO-2.02 µm           | $1.48 \times 10^{14}$ | 0.030 |
| NACO-K                 | $1.36 \times 10^{14}$ | 0.031 |
| NACO-L                 | $8.57 \times 10^{13}$ | 0.20 |
| MIDI-8 µm              | $3.70 \times 10^{13}$ | 0.60 |
| MIDI-12 µm             | $2.50 \times 10^{13}$ | 1.1 |
| MIDI-13 µm             | $2.30 \times 10^{13}$ | 1.3 |
| MIDIcorre-8.3 µm       | $3.60 \times 10^{13}$ | 0.47 |
| MIDIcorre-9.3 µm       | $3.20 \times 10^{13}$ | 0.28 |
| MIDIcorre-10.4 µm      | $2.88 \times 10^{13}$ | 0.25 |
| MIDIcorre-11.4 µm      | $2.63 \times 10^{13}$ | 0.43 |
| MIDIcorre-12.6 µm      | $2.30 \times 10^{13}$ | 0.62 |
| VISIR-11.88 µm         | $2.56 \times 10^{13}$ | 1.1 |
| VISIR-18.72 µm         | $1.70 \times 10^{13}$ | 2.3 |
| VLBA-1997              | $2.22 \times 10^{10}$ | 1.9 |
| VLBA-1997              | $8.40 \times 10^9$ | 1.7 |
| VLBA-1999              | $8.4 \times 10^9$ | 2.32 |
| VLBA-1999              | $5.0 \times 10^9$ | 0.83 |
| VLBA-1999              | $2.2 \times 10^9$ | 1.03 |
| IRAS-12 µm             | $2.50 \times 10^{13}$ | 22. |
| IRAS-25 µm             | $1.20 \times 10^{13}$ | 28. |
| IRAS-60 µm             | $5.00 \times 10^{12}$ | 2.1 x $10^2$ |
| IRAS-100 µm            | $3.00 \times 10^{12}$ | 4.1 x $10^2$ |
| ISO-170 µm             | $1.76 \times 10^{12}$ | 5.4 x $10^2$ |
| SCUBA-350 µm           | $8.66 \times 10^{11}$ | 7.7 |
| SCUBA-450 µm           | $6.67 \times 10^{11}$ | 7.9 |
| SCUBA-750 µm           | $4.07 \times 10^{11}$ | 8.1 |
| SCUBA-850 µm           | $3.50 \times 10^{11}$ | 8.1 |

Data sources and associated spatial resolutions are given in the object section. The large aperture data in the IR, shown with crosses in the SED in Fig.1, are added at the end of the table.
Table 4. SED of Circinus core region

| Origin         | Hz          | Jy          |
|----------------|-------------|-------------|
| INTEGRAL 40-100 keV | $1.69 \times 10^{19}$ | $5.5 \times 10^{-7}$ |
| INTEGRAL 20-40 keV  | $7.25 \times 10^{18}$ | $1.5 \times 10^{-6}$ |
| INTEGRAL 2-10 keV   | $1.45 \times 10^{18}$ | $8.9 \times 10^{-7}$ |
| ROSAT 1.3 keV       | $3.25 \times 10^{17}$ | $4.0 \times 10^{-6}$ |
| NACO-J              | $2.30 \times 10^{14}$ | $< 0.0016$   |
| NACO-H              | $1.76 \times 10^{14}$ | $0.0048$     |
| NACO-K              | $1.36 \times 10^{14}$ | $0.019$      |
| NACO-2.42μm         | $1.24 \times 10^{14}$ | $0.031$      |
| NACO-L              | $7.90 \times 10^{13}$ | $0.38$       |
| NACO-M              | $6.70 \times 10^{13}$ | 1.9          |
| MIDIcorr-8 μm       | $4.00 \times 10^{13}$ | 0.30         |
| MIDIcorr-9.6 μm     | $3.10 \times 10^{13}$ | 0.30         |
| MIDIcorr-11 μm      | $2.50 \times 10^{13}$ | 0.50         |
| MIDIcorr-12 μm      | $2.00 \times 10^{13}$ | 1.1          |
| MIDI-8 μm           | $3.70 \times 10^{13}$ | 6.0          |
| MIDI-9.6 μm         | $3.10 \times 10^{13}$ | 2.8          |
| VISIR-11.88 μm      | $2.50 \times 10^{13}$ | 9.3          |
| VISIR-18.72 μm      | $1.60 \times 10^{13}$ | 17.6         |
| ATCA-3 cm           | $1.00 \times 10^{10}$ | 0.050        |
| ATCA-6 cm           | $5.00 \times 10^{9}$  | 0.050        |
| ATCA-13 cm          | $2.30 \times 10^{9}$  | 0.070        |
| ATCA-20 cm          | $1.50 \times 10^{9}$  | 0.12         |
| IRAS-12 μm          | $2.50 \times 10^{13}$ | 19.0         |
| IRAS-25 μm          | $1.20 \times 10^{13}$ | 68.0         |
| IRAS-60 μm          | $5.00 \times 10^{12}$ | 249.0        |
| IRAS-100 μm         | $3.00 \times 10^{12}$ | 316.0        |

Data sources and associated spatial resolutions are given in the object section. The large aperture data in the IR, shown with crosses in the SED in Fig.1, are added at the end of the table.
Table 5. SED of NGC 1068 core region

| Origin                  | Hz       | Jy       |
|-------------------------|----------|----------|
| INTEGRAL-40-100 keV     | 1.69×10^{19} | 9.8×10^{-8} |
| INTEGRAL-20-40 keV      | 7.25×10^{18} | 1.3×10^{-7} |
| EXOSAT-2-10 keV         | 1.45×10^{18} | 3.7×10^{-7} |
| CHANDRA-1 keV           | 2.42×10^{17} | 1.5×10^{-7} |
| NACO-J                  | 2.30×10^{14} | <0.0024  |
| NACO-H                  | 1.76×10^{14} | 0.0056   |
| NACO-K                  | 1.36×10^{14} | 0.056    |
| NACO-2.42               | 1.24×10^{14} | 0.12     |
| NACO-M                  | 6.70×10^{13} | 1.5      |
| MIDIcorr-8 μm           | 3.75×10^{13} | 1.9      |
| MIDIcorr-9.6 μm         | 3.1×10^{13} | 0.4      |
| MIDIcorr-12 μm          | 2.5×10^{13} | 1.2      |
| MIDIcorr-13 μm          | 2.3×10^{13} | 1.9      |
| Subaru-8.72μm           | 3.4×10^{13} | 5.81     |
| Subaru-9.69μm           | 3.1×10^{13} | 4.03     |
| Subaru-10.38μm          | 2.9×10^{13} | 3.82     |
| Subaru-11.66μm          | 2.6×10^{13} | 10.2     |
| Subaru-12.33μm          | 2.4×10^{13} | 9.3      |
| Subaru-18.5 μm          | 1.60×10^{13} | 9.6      |
| Keck-25 μm              | 1.20×10^{13} | 9.6      |
| IRAM-1 mm               | 2.30×10^{11} | 0.022    |
| IRAM-3 mm               | 1.15×10^{11} | 0.036    |
| VLA-A                   | 4.30×10^{10} | 0.013    |
| VLA-A                   | 2.25×10^{10} | 0.016    |
| VLBA                     | 8.40×10^{9}  | 0.0054   |
| VLBA                     | 5.00×10^{9}  | 0.0091   |
| VLBA                     | 1.70×10^{9}  | <0.0026  |
| IRAS-12 μm              | 2.50×10^{13} | 40.      |
| IRAS-25 μm              | 1.20×10^{13} | 85.      |
| IRAS-60 μm              | 5.00×10^{12} | 1.8×10^{2} |
| IRAS-100 μm             | 3.00×10^{12} | 2.8×10^{2} |
| ISO-170 μm              | 1.76×10^{12} | 3.9×10^{2} |
| MKO-390 μm              | 7.69×10^{11} | 30.      |
| CTIO-540 μm             | 5.55×10^{11} | 7.0      |

Data sources and spatial scales are given in the object section. The large aperture data in the IR, shown with crosses in the SED in Fig.1, are added at the end of the table.
Table 6. SED of NGC 1097 core region

| Origin       | Hz       | Jy        |
|--------------|----------|-----------|
| ASCA-2-10 keV | 2.42×10^{18} | 8.5×10^{-8} |
| ASCA-0.5-4 keV | 2.42×10^{17} | 2.4×10^{-7}  |
| WFPC2-F218W   | 1.40×10^{15} | 1.8×10^{-5}  |
| WFPC-F555W    | 5.41×10^{14} | 8.8×10^{-5}  |
| ACSWF-F814W   | 3.60×10^{14} | 0.00074    |
| NACO-J        | 2.30×10^{14} | 0.0011     |
| NACO-H        | 1.76×10^{14} | 0.0027     |
| NACO-K        | 1.36×10^{14} | 0.0039     |
| NACO-L        | 7.90×10^{13} | 0.011      |
| VISIR-11.88 μm | 2.50×10^{13} | 0.025      |
| VISIR-18.72 μm | 1.60×10^{13} | 0.041      |
| VLA-B         | 1.50×10^{10} | 0.0056     |
| VLA-A         | 8.40×10^{9}  | 0.0031     |
| VLA-A         | 4.80×10^{9}  | 0.004      |
| VLA-B         | 1.40×10^{9}  | 0.0012     |

Data sources and spatial scales are given in the object section. The large aperture data in the IR, shown with crosses in the SED in Fig.1, are added at the end of the table.
Table 7. SED of NGC 7582 core region

| Origin                  | Hz          | Jy           |
|-------------------------|-------------|--------------|
| SAX 20-100 keV          | 1.45×10^{19} | 8.1×10^{-7}  |
| XMM 2-12 keV            | 1.69×10^{18} | 1.4×10^{-6}  |
| ASCA 0.5-2 keV 3.03×10^{17} | 1.46×10^{-7} |              |
| WFPC2-F606W             | 5.00×10^{14} | 3.0×10^{-6}  |
| NICMOS-F160W            | 1.88×10^{14} | 0.011        |
| NACO-2.06 μm            | 1.46×10^{14} | 0.018        |
| NACO-L                  | 7.89×10^{13} | 0.096        |
| NACO-4.05 μm            | 7.41×10^{13} | 0.11         |
| TIMMI2-spec-8.5 μm      | 3.53×10^{13} | 0.3          |
| TIMMI2-spec-9 μm        | 3.33×10^{13} | 0.2          |
| TIMMI2-spec-9.6 μm      | 3.13×10^{13} | 0.08         |
| TIMMI2-spec-11 μm       | 2.73×10^{13} | 0.2          |
| TIMMI2-spec-12 μm       | 2.50×10^{13} | 0.4          |
| VISIR-11.88 μm          | 2.52×10^{13} | 0.40         |
| VISIR-18.72 μm          | 1.60×10^{13} | 0.55         |
| VLA-A                   | 8.40×10^{9}  | 0.0069       |
| VLA-A                   | 5.00×10^{9}  | 0.0095       |

Data sources and spatial scales are given in the object section. The large aperture data in the IR, shown with crosses in the SED in Fig.1, are added at the end of the table.
Table 8. SED of NGC 5506 core region

| Origin              | Hz       | Jy       |
|---------------------|----------|----------|
| INTEGRAL-40-100 keV | 1.69×10^{19} | 2.2×10^{-7} |
| INTEGRAL-20-40 keV  | 7.25×10^{18} | 5.8×10^{-7} |
| INTEGRAL-2-10 keV   | 1.45×10^{18} | 6.1×10^{-6} |
| Einstein-0.2-4 keV  | 5.25×10^{17} | 2.1×10^{-6} |
| WFPC2-V+R           | 5.00×10^{14} | < 2.9×10^{-5} |
| NACO-J              | 2.30×10^{14} | 0.013    |
| NACO-H              | 1.76×10^{14} | 0.053    |
| NACO-K              | 1.36×10^{14} | 0.080    |
| NACO-L              | 7.90×10^{13} | 0.29     |
| ISO-spec-6 μm       | 5.00×10^{13} | 0.70     |
| TIMMI2-spec-9.6 μm  | 3.0×10^{13}  | 0.5      |
| VISIR-11.88 μm      | 2.50×10^{13} | 0.9      |
| VISIR-18.72 μm      | 1.70×10^{13} | 1.4      |
| VLBA-1997           | 8.33×10^{9}  | 0.022    |
| VLBI-1994           | 5.00×10^{9}  | 0.034    |
| VLBA-1997           | 5.00×10^{9}  | 0.030    |
| VLBA-2000           | 5.00×10^{9}  | 0.042    |
| PTI-1990            | 2.30×10^{9}  | 0.087    |
| VLBA-1997           | 1.60×10^{9}  | 0.024    |
| VLBA-2000           | 1.60×10^{9}  | 0.046    |
| ==============      | =========== | ========= |
| IRAS-12 μm          | 2.50×10^{13} | 1.3      |
| IRAS-25 μm          | 1.20×10^{13} | 4.2      |
| IRAS-60 μm          | 5.00×10^{12} | 8.4      |
| IRAS-100 μm         | 3.00×10^{12} | 8.9      |

Data sources and corresponding spatial scales are given in the object section. The large aperture data in the IR, shown with crosses in the SED in Fig.1, are added at the end of the table.
Table 9. SED of NGC 1566 core region

| Origin                  | Hz        | Jy         |
|-------------------------|-----------|------------|
| SAX-20-100 keV          | 1.45×10^{19} | 5.6×10^{-7} |
| Einstein-2-4 keV        | 5.25×10^{17} | 2.8×10^{-6} |
| FOS-1300 A              | 2.30×10^{15} | 5.6×10^{-5} |
| FOS-1400 A              | 2.10×10^{15} | 8.0×10^{-5} |
| FOS-1800 A              | 1.67×10^{15} | 0.00016    |
| FOS-2100 A              | 1.40×10^{15} | 0.00021    |
| WFPC2-160BW             | 1.87×10^{15} | 0.00011    |
| WFPC2-F336W             | 8.92×10^{14} | 0.00038    |
| WFPC2-F547M             | 5.48×10^{14} | 0.00050    |
| WFPC2-F555W             | 5.40×10^{14} | 0.00053    |
| WFPC2-F814W             | 3.68×10^{14} | 0.00079    |
| NACO-J                  | 2.37×10^{14} | 0.0011     |
| NACO-K                  | 1.38×10^{14} | 0.0021     |
| NACO-L                  | 7.90×10^{13} | 0.0078     |
| VISIR-11.88 μm          | 2.50×10^{13} | 0.059      |
| VISIR-18.72 μm          | 1.60×10^{13} | 0.11       |
| ATCA-8.4 GHz            | 8.40×10^{9}  | 0.0080     |
| PTI-2.3 GHz             | 2.30×10^{9}  | 0.0050     |
| PTI-1.7 GHz             | 1.70×10^{9}  | <0.006     |

Data sources and spatial scales are given in the object section. The large aperture data in the IR, shown with crosses in the SED in Fig.1, are added at the end of the table.
Table 10. SED of NGC 3783 core region

| Origin             | Hz       | Jy          |
|--------------------|----------|-------------|
| OSSE 50-150 keV    | 2.42×10^{19} | 2.9×10^{-7} |
| INTEGRAL 17-60 keV | 9.31×10^{18} | 1.3×10^{-6} |
| XMM 2-10 keV       | 1.45×10^{18} | 3.9×10^{-6} |
| Einstein 0.2-4 Kev | 5.25×10^{17} | 7.9×10^{-6} |
| FUSE-1040 A        | 3.00×10^{15} | 0.001       |
| STIS-1150 A        | 2.70×10^{15} | 0.0016      |
| STIS-1346 A        | 2.20×10^{15} | 0.0023      |
| STIS-1480 A        | 2.00×10^{15} | 0.0025      |
| STIS-2279 A        | 1.30×10^{15} | 0.0045      |
| STIS-2419 A        | 1.20×10^{15} | 0.0056      |
| STIS-2640 A        | 1.13×10^{15} | 0.0065      |
| STIS-2900 A        | 1.00×10^{15} | 0.0075      |
| STIS-3100 A        | 9.70×10^{14} | 0.0076      |
| LCO-U              | 8.19×10^{14} | 0.0056      |
| ACS-F547M          | 5.48×10^{14} | 0.0060      |
| ACS-F550M          | 5.45×10^{14} | 0.0066      |
| WFPC2-F814W         | 3.68×10^{14} | 0.0099      |
| NACO-J             | 2.30×10^{14} | 0.023       |
| NACO-K             | 1.36×10^{14} | 0.073       |
| NACO-L             | 7.90×10^{13} | 0.17        |
| VISIR-11.88 μm     | 2.50×10^{13} | 0.54        |
| VISIR-18.72 μm     | 1.60×10^{13} | 1.47        |
| VLA-A              | 8.40×10^{9}  | 0.0080      |
| VLA-A              | 4.80×10^{9}  | 0.013       |
| VLA-A              | 1.40×10^{9}  | 0.023       |
| ===========       | ===========  | =========== |
| IRAS-12 μm        | 2.50×10^{13} | 0.84        |
| IRAS-25 μm        | 1.20×10^{13} | 2.5         |
| IRAS-60 μm        | 5.00×10^{12} | 3.3         |
| IRAS-100 μm       | 3.00×10^{12} | 4.9         |

Data sources and corresponding spatial scales are given in the object section. The large aperture data in the IR, shown with crosses in the SED in Fig.1, are added at the end of the table.
### Table 11. SED of NGC 7469 core region

| Origin            | Hz         | Jy         |
|-------------------|------------|------------|
| INTEGRAL-17-60 keV| $9.31 \times 10^{18}$ | $5.1 \times 10^{-7}$ |
| XMM-2-10 keV      | $1.45 \times 10^{18}$ | $2.9 \times 10^{-6}$ |
| ROSAT-0.1-2.4 keV | $2.42 \times 10^{17}$ | $9.1 \times 10^{-6}$ |
| WFPC2-F218W       | $1.36 \times 10^{15}$ | 0.0027     |
| ACS-F330W         | $8.92 \times 10^{14}$ | 0.0031     |
| WFPC2-F547M       | $5.47 \times 10^{14}$ | 0.0029     |
| ACS-F550M         | $5.38 \times 10^{14}$ | 0.0022     |
| ACS-F814W         | $3.75 \times 10^{14}$ | 0.0042     |
| NACO-J            | $2.37 \times 10^{14}$ | 0.0080     |
| NACO-H            | $1.81 \times 10^{14}$ | 0.015      |
| NICMOS-F187N      | $1.60 \times 10^{14}$ | 0.019      |
| NACO-K            | $1.38 \times 10^{14}$ | 0.020      |
| NACO-L            | $7.89 \times 10^{13}$ | 0.081      |
| NACO-4.05 µm      | $7.41 \times 10^{13}$ | 0.096      |
| VISHR-11.88 µm    | $2.53 \times 10^{13}$ | 0.53       |
| VISHR-18.72 µm    | $1.60 \times 10^{13}$ | 1.27       |
| VLA-A             | $1.49 \times 10^{10}$ | 0.011      |
| VLA-A             | $8.40 \times 10^{9}$  | 0.015      |
| MERLIN            | $5.00 \times 10^{9}$  | 0.012      |
| VLBI              | $2.30 \times 10^{9}$  | 0.014      |
| VLBI              | $1.70 \times 10^{9}$  | 0.021      |
| IRAS-12 µm        | $2.50 \times 10^{13}$ | 1.6        |
| Spitzer-15 µm     | $2.00 \times 10^{13}$ | 1.5        |
| Spitzer-20 µm     | $1.50 \times 10^{13}$ | 3.2        |
| IRAS-25 µm        | $1.20 \times 10^{13}$ | 6.0        |
| Spitzer-30 µm     | $9.99 \times 10^{12}$ | 7.8        |
| IRAS-60 µm        | $5.00 \times 10^{12}$ | 27.3       |
| IRAS-100 µm       | $3.00 \times 10^{12}$ | 35.2       |
| Caltech-350 µm    | $8.57 \times 10^{11}$ | 2.23       |
| SCUBA-850 µm      | $3.53 \times 10^{11}$ | 0.19       |

Data sources and spatial scales are given in the object section. The large aperture data in the IR, shown with crosses in the SED in Fig.1, are added at the end of the table.
### Table 12. SED of 3C 273 core region

| Origin   | Hz  | Jy     |
|----------|-----|--------|
| 1 GeV    | $2.42 \times 10^{23}$ | $1.4 \times 10^{-11}$ |
| 300 MeV  | $7.25 \times 10^{22}$ | $8.8 \times 10^{-11}$ |
| 100 MeV  | $2.42 \times 10^{22}$ | $4.8 \times 10^{-10}$ |
| 3 MeV    | $7.25 \times 10^{20}$ | $5.6 \times 10^{-8}$  |
| 1 MeV    | $2.40 \times 10^{20}$ | $1.8 \times 10^{-7}$  |
| 500 keV  | $1.21 \times 10^{20}$ | $2.9 \times 10^{-7}$  |
| 100 keV  | $2.42 \times 10^{19}$ | $1.1 \times 10^{-6}$  |
| 50 keV   | $1.21 \times 10^{19}$ | $1.6 \times 10^{-6}$  |
| 10 keV   | $4.84 \times 10^{18}$ | $3.3 \times 10^{-6}$  |
| 5 keV    | $2.42 \times 10^{18}$ | $4.2 \times 10^{-6}$  |
| 2 keV    | $4.84 \times 10^{17}$ | $8.7 \times 10^{-6}$  |
| 1 keV    | $2.42 \times 10^{17}$ | $1.4 \times 10^{-5}$  |
| 0.5 keV  | $1.21 \times 10^{17}$ | $2.9 \times 10^{-5}$  |
| 0.2 keV  | $4.84 \times 10^{16}$ | $9.5 \times 10^{-5}$  |
| 0.1 keV  | $2.42 \times 10^{16}$ | $2.48 \times 10^{-4}$ |
| 1300 A   | $2.31 \times 10^{15}$ | 0.012               |
| 2100 A   | $1.43 \times 10^{15}$ | 0.019               |
| 3000 A   | $9.99 \times 10^{14}$ | 0.025               |
| U        | $8.57 \times 10^{14}$ | 0.027               |
| B        | $7.00 \times 10^{14}$ | 0.027               |
| V        | $5.50 \times 10^{14}$ | 0.029               |
| R        | $4.43 \times 10^{14}$ | 0.027               |
| I        | $3.37 \times 10^{14}$ | 0.028               |
| NACO-J   | $2.30 \times 10^{14}$ | 0.032               |
| NACO-H   | $1.76 \times 10^{14}$ | 0.047               |
| NACO-K   | $1.36 \times 10^{14}$ | 0.068               |
| NACO-L   | $7.90 \times 10^{13}$ | 0.17                |
| NACO-M   | $6.70 \times 10^{13}$ | 0.17                |
| VLBI-2 mm| $1.47 \times 10^{11}$ | 2.2                 |
| VLBI-3 mm| $1.00 \times 10^{11}$ | 8.0                 |
| VLBI     | $8.60 \times 10^{10}$ | 7.88                |
| VLBI     | $4.30 \times 10^{10}$ | 6.66                |
| VLBI     | $2.20 \times 10^{10}$ | 4.99                |
| VLBA     | $1.50 \times 10^{10}$ | 9.18                |
| VLBI     | $5.00 \times 10^{9}$  | 12.7                |
| ISO-6.7 μm| $4.44 \times 10^{13}$ | 0.19               |
| ISO-14.3 μm| $2.00 \times 10^{13}$ | 0.29               |
| ISO-80 μm | $3.70 \times 10^{12}$ | 1.29               |
| ISO-100 μm| $2.90 \times 10^{12}$ | 1.35               |
| ISO-120 μm| $2.52 \times 10^{12}$ | 1.55               |
| ISO-150 μm| $1.86 \times 10^{12}$ | 1.11               |
| ISO-170 μm| $1.72 \times 10^{12}$ | 1.29               |
| ISO-180 μm| $1.62 \times 10^{12}$ | 1.06               |
SED of nearby galaxy cores

Table 12—Continued

| Origin | Hz   | Jy   |
|--------|------|------|
| ISO-200 µm | 1.47×10^{12} | 1.09 |

The SED from 1 GeV to the I-band is taken directly from Turler et al. (1999). Further data are compiled in this work and the sources are given in the corresponding section for this object. The large aperture data in the IR, shown with crosses in the SED in Fig.1, are added at the end of the table.

Table 13. Galaxies observed with adaptive optics in the near-IR with VLT / NACO

| Name   | Filters (observing date) | Reference          |
|--------|--------------------------|--------------------|
| Cen A  | J, H, NB-2.02 µm, L (March - May 2003), K (March 2004) | Haering-Neumayer et al. 2006 |
| Circinus | J, K, NB-2.42 µm, L.M (March - May 2003) | Prieto et al. 2004 |
| NGC 1068 | K, M (Nov -Dec 2002), J, H (Jan 2004) J, NB-2.42 µm (Jan 2005) | Hoenig et al. 2008 |
| NGC 7582 | 2.06 µm (May - Jun 2005), L, NB-4.05 µm (Dec 2005) | Fernandez-Ontiveros et al. 2009 |
| NGC 5506 | J, K, L, M (Jun 2003) | this work |
| NGC 1097 | J, H, K ( Aug 2002), L (Jan 2005) | Prieto et al. 2005 |
| NGC 1566 | K, L (Jan 2005), J ( Nov 2005) | this work |
| NGC 3783 | J,K,L (Jan 2005) | this work |
| NGC 7469 | J, H, K (Nov 2002), L, NB-4.05 µm (Dec 2005 ) | this work |
| 3C 273 | J,K,L, M (May 2003) | this work |

Galaxies sorted by distance.