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AGN ACTIVITY AND CIRCUMNUCLEAR STAR FORMATION IN NEARBY GALAXIES

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We have selected a sample of nearby galaxies where an AGN (Seyfert or LINER) coexists with circumnuclear star formation. We use the highest spatial resolution data available now (*HST* UV, optical, and near-infrared [IR]; radio) and in the future (mid-IR with *Spitzer* and CanariCam) with spatial resolutions of 3-25 pc for our sample. The main goal of this project is to determine the bolometric importance of both phenomena in nearby galaxies by careful modelling of the UV to radio spectral energy distributions. In this paper we present results for NGC 7469 and NGC 5253, and discuss possible observations with CanariCam on the GTC.

1. INTRODUCTION

Current evidence implies that the peak of star formation (SF) activity in galaxies occurred at an epoch similar to that when quasars appear to have had their maximum space density. The relation between the SF history of a galaxy and the genesis and evolution of an active nucleus (AGN) remains an open question. The central kpc of galaxies is the natural habitat where these two energetic phenomena, episodes of SF and the accretion onto a supermassive black hole leading to AGN activity, may coexist. Moreover, SF is thought to be a possible mechanism for fueling AGN. In the Local Universe simultaneous SF and AGN activity are commonly observed in Luminous IR Galaxies and Ultraluminous IR Galaxies (LIRGs and ULIRGs, respectively), and in nearby galaxies but at lower luminosities.

We have selected a sample of nearby galaxies with circumnuclear SF (usually distributed in a ring) and different degrees of non-stellar activity, including LINERs and Seyferts. Most of these galaxies are included in the Gu et al. (2001) sample. In addition we select galaxies with nuclear and rings of SF, but no evidence for AGN activity, as a comparison sample.

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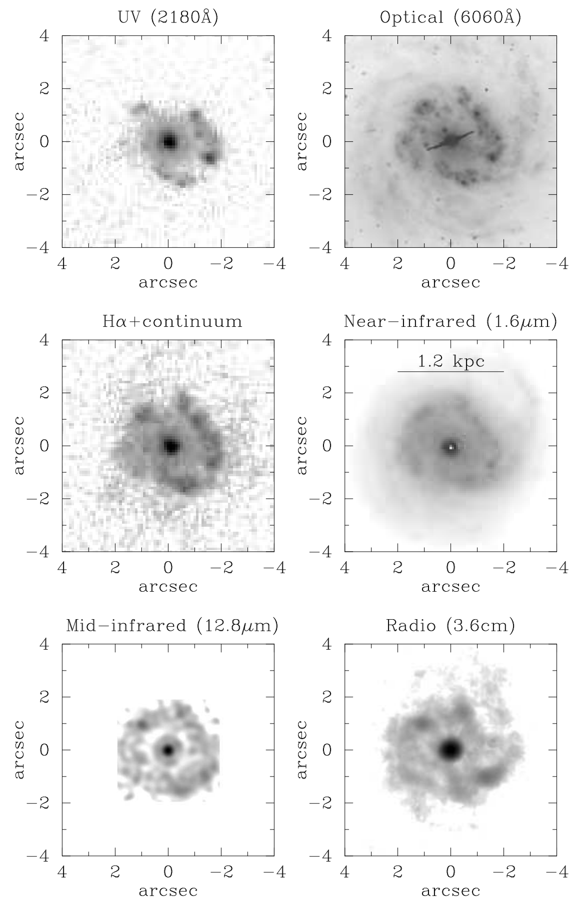

Fig. 1. Central $8'' \times 8''$ region of NGC 7469 at UV, optical, and near-IR (from *HST*), mid-IR (from Keck, Soifer et al. 2003), and radio (from the VLA) wavelengths.

The final criterion to include galaxies in our sample is the availability of *HST*/UV through near-IR imaging, as well as *Spitzer* mid- and far-IR ($3 - 160\,\mu$m) observations. High spatial resolution mid-IR observations with CanariCam will be proposed. For our sample of galaxies *HST* provides spatial resolutions of $\simeq 3 - 25\,$pc ($H_0 = 75\,\mathrm{km\,s^{-1}\,Mpc^{-1}}$), sufficient to isolate the sites of SF and the central AGN. The UV–mid-IR coverage will allow us to make a detailed analysis of both the SF and AGN activity using their spectral energy distributions (SEDs).

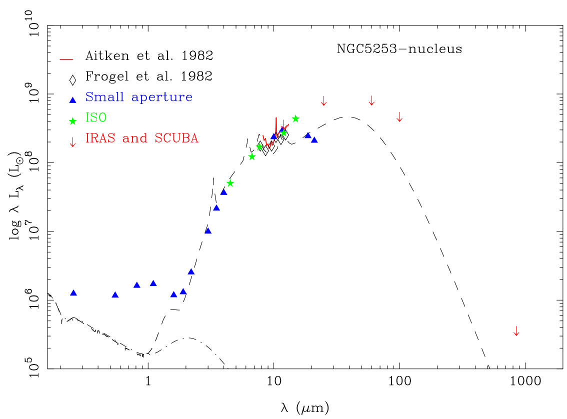

Fig. 2. SED of the nuclear double cluster of NGC 5253. The dashed line is the best fit to the data using the Takagi et al. (2003) model, whereas the dashed-dotted line is the stellar contribution to this fit.

2. MULTIWAVELENGTH VIEW OF NGC 7469

NGC 7469 is a nearby ($d = 65\,\mathrm{Mpc}$) LIRG that contains a Seyfert 1 nucleus and a ring of SF (Wilson et al. 1991) of about 1 kpc in diameter. The ring is detected in the UV, optical, near- and mid-IR (Soifer et al. 2003), and radio (Colina et al. 2001), as shown in Fig. 1. Genzel et al. (1995) established that approximately two thirds of the bolometric luminosity of this galaxy is produced by the ring of SF.

We have obtained UKIRT K-band spectroscopy of star clusters in the SF ring of this galaxy. The measured equivalent widths of Brγ and the CO index (at $2.3\,\mu$m) indicate a uniform range of ages, $6-7$ million years, for these IR clusters. A detailed modelling of their SEDs will allow us to derive stellar masses, ages, SF rates, and bolometric luminosities for individual clusters and the ring as a whole.

3. THE DWARF GALAXY NGC 5253

NGC 5253 is a nearby ($d = 4.1\,\mathrm{Mpc}$) dwarf galaxy thought to be undergoing one of the youngest episodes of SF in the Local Universe.

Using *HST*/NICMOS imaging Alonso-Herrero et al. (2004) have shown that the nucleus of this galaxy is resolved into two near-IR star clusters. The brightest of the two is almost completely obscured at UV and optical wavelengths, and it is responsible for most of the nuclear mid-IR emission of this galaxy. Both clusters are about three million years old, and have stellar masses in the range $M = 10^5 - 2\times10^6\,\mathrm{M}_\odot$.

The nuclear UV–mid-IR SED of NGC 5253 has been fitted with the Tagaki et al. (2003) model (Fig. 2 and Alonso-Herrero et al. 2004). The mid-IR data are from ground-based observations (Frogel et al. 1982; Aitken et al. 1982) and *ISO* at moderate (a few arcsec) spatial resolutions. The SED is reproduced with a 3×10^6 yr burst which formed $\simeq 3\times10^6\,\mathrm{M}_\odot$ in stars, and a dust mass of $5\times10^4\,\mathrm{M}_\odot$. The emitting region is 21 pc in diameter and has an optical depth of $A_V = 16\,\mathrm{mag}$. The central double cluster of NGC 5253 accounts for approximately 50% of the bolometric luminosity of this galaxy.

Future imaging and spectroscopic observations with CanariCam on the GTC for our sample of galaxies will allow us to isolate and model star clusters and AGNs at sub-arcsecond resolutions to determine their relative bolometric contributions.

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REFERENCES

Aitken, D. K. et al. 1982, MNRAS, 199, 31
Alonso-Herrero, A. et al. 2004, ApJ, in press
Colina, L. et al. 2001, ApJ, 533, L19
Frogel, J. F. et al. 1982, ApJ, 260, 70
Genzel, R. et al. 1995, ApJ, 444, 129
Gu, Q. et al. 2001, RevMexAA, 37, 3
Soifer, T. et al. 2003, AJ, 126, 143
Takagi, T. et al. 2003, PASJ, 55, 385
Wilson, A. et al. 1991, ApJ, 381, 79