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NGC 1097 AT HIGH SPATIAL RESOLUTION IN THE MID-INFRARED

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The possibility that the dusty torus of AGN unified schemes is connected with star formation activity has been raised by many authors. Some or all of the nuclear obscuration might originate in clouds ejected from a starburst (e.g. Watabe & Umemura 2005), which could also provide the energy necessary to maintain the thickness of the torus. Star formation is quite commonly observed in AGN on few hundred pc scales, but the mid-IR emitting regions of the torus are much smaller, perhaps only a few pc across. The recent detection of a 10^6M$_\odot$, 10^6 yr-old stellar cluster $<$ 9 pc from the nucleus of the nearby LINER/Sy1 galaxy, NGC1097 (Storchi-Bergmann et al. 2005) may therefore be a rare example of a starburst physically associated with an AGN torus.

To search for the thermal emission expected from dust close to an accreting supermassive black hole, we have obtained Gemini/T-ReCS images at 11.7 and 18.5 μm of the inner regions of NGC1097. Emission is clearly seen in both bands from the nucleus and kpc-scale starforming ring. We place a limit on the FWHM of the central source of 0.43″ or 37 pc at 17 Mpc, which is comparable in size to the nuclear mid-IR sources in nearby Seyfert galaxies (e.g. Radomski et al. 2003). As processes other than dust emission can contribute to the mid-IR flux from galactic nuclei, we compare the mid-IR luminosity of the nuclear point source with the starburst+jet+thin accretion disk+RIAF model of Nemmen et al. (2006). The luminosity that we measure is an order of magnitude higher than predicted by the model, which does not include dust emission, indicating that the emission we detect is from warm dust in the nucleus of NGC1097. This dust would obscure the type-1 nucleus from some angles.

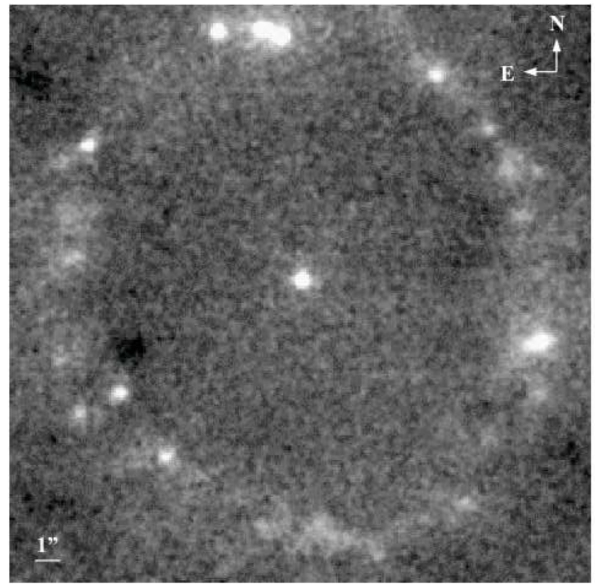

Fig. 1. T-ReCS 11.7 image of NGC1097, smoothed with a 2-pixel Gaussian. The negative off-source images can be seen at either side of the positive galaxy image.

Fitting clumpy torus models to the T-ReCS data plus the JHK data of Prieto et al. (2005) shows that there must be a substantial contribution to the dust heating from the compact starburst; the weak AGN cannot heat the dust adequately to fully account for the observations. Although the geometry of the nuclear dust cannot be directly confirmed, it appears to lie at the confluence of spiral streams of material flowing to the nucleus (Prieto et al. 2005; Fathi et al. 2006) implying that it may well be the dusty torus of AGN unified schemes. If so, the starburst and torus are intimately physically connected in NGC1097.

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