DIFFRACTION-LIMITED IR SPECKLE MASKING OBSERVATIONS OF THE CENTRAL REGIONS OF SEYFERT GALAXIES

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We present speckle masking observations ([2],[4]) of Seyfert galaxies with the Russian 6 m telescope. Diffraction-limited resolution of 76 mas in the K-band was obtained for the first time. This resolution is similar to the resolution of recent MERLIN and VLA observations of galactic centers, thus allowing us to study the radio-IR spectrum of the same structures. Figure 1 shows the decreasing K-band visibility function of NGC 1068 and the contour plot of our reconstructed image ([5]). The results show that NGC 1068 is resolved with a FWHM diameter of 30 mas or 2 pc for an assumed Gaussian flux distribution. The image is elongated in northern direction, which is approximately the direction of the radio jet. In the right panel of figure 1 the observed flux values at 5,15 and 22 GHz (from [3]) are plotted together with our K-band flux. The spectral index between 5 GHz and the K-band is approximately 1/3. This spectrum can be explained by synchrotron emission of quasi-monoenergetic relativistic electrons (as for our Galactic Center by [1]). Assuming that the observed flux is mainly nuclear light (from, for example, scattering lobes above and below a torus, without absorption and re-emission) we use the same synchrotron model as has been used for the Galactic Center to explain our data. With this model, we find a source radius of $R \sim 10^{15}$ cm, a magnetic field of $B \sim 11$ G, a electron number density of $n_e \sim 1.1\,10^3$ cm^{-3} and a mean electron energy of ~ 2.7 GeV. The corresponding model spectrum is shown in the right panel of fig. 1. The observed flux value at 2.2 μm lies slightly above the model spectrum. This could be caused by flux contributions from additional components, for example, a central stellar cluster, an accretion disk or thermal radiation from a dusty torus. We have also observed the central regions of other galaxies. For example, for NGC 4151, we found a dominant

Y. Sofue (ed.), The Central Regions of the Galaxy and Galaxies, 103-104.

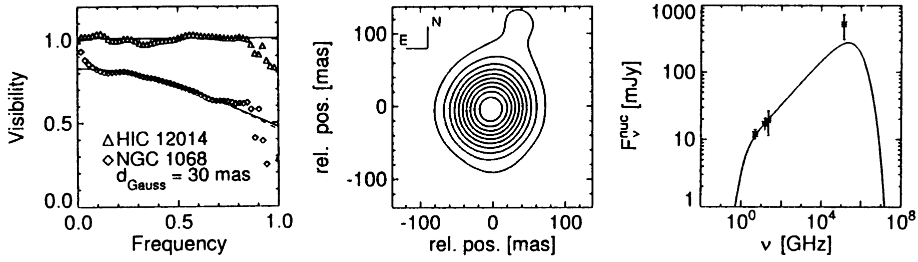

Figure 1. Left: Azimuthally averaged visibilities of NGC 1068 and the unresolved reference star. Middle: Contour plot of the reconstructed image. Right: A comparison of the model spectrum with the flux determinations at 5,15,22 GHz and 2.2 μm.

central core, which is not resolved, and therefore has a diameter of < 20 mas.

References

[1] Beckert T. et al., 1996, A&A307, 450
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[5] Wittkowski M.. et al., 1997, submitted

M. DOPITA: You have not considered the possibility that the K-band object is simply the region of hot dust near its sublimation temperature. This should be visible, given that NGC 1068 is a hidden broad-line region (HBLR) Seyfert, and the sublimation radius for the object is 2-3 pc, similar to what you observe. Could you comment on the possibility that hot dust emission is the dominant emission process at K ?

M. WITTKOWSKI: Yes, this is another possibility. We make our hypothesis, because the spectral index is just very close to 1/3 and a hot dust emission possibly peaks in the MIR and FIR and not already at 2.2 μm.

N. THATTE: NGC 1068 has a steeply rising spectrum in the K-band, which would need a spectral index $\alpha = 4.9$ ($S_\nu \sim \nu^{-\alpha}$) to fit it. This is inconsistent with a synchrotron origin to the near-IR compact emission.

M. WITTKOWSKI: The K-band flux contain, of course, additional contributions, which could change the spectral index of the 30 mas source.

H. ZINNECKER: Have you also obtained H-band speckle images in order to determine the infrared colour of the 2 pc infrared core of NGC 1068 ? This would help to constrain its nature.

M. WITTKOWSKI: Yes, we have obtained H-band images. I agree, further observations with similar spatial resolution at other wavelengths are needed to constrain the models.