Near-Infrared Mapping of Spiral Barred Galaxies

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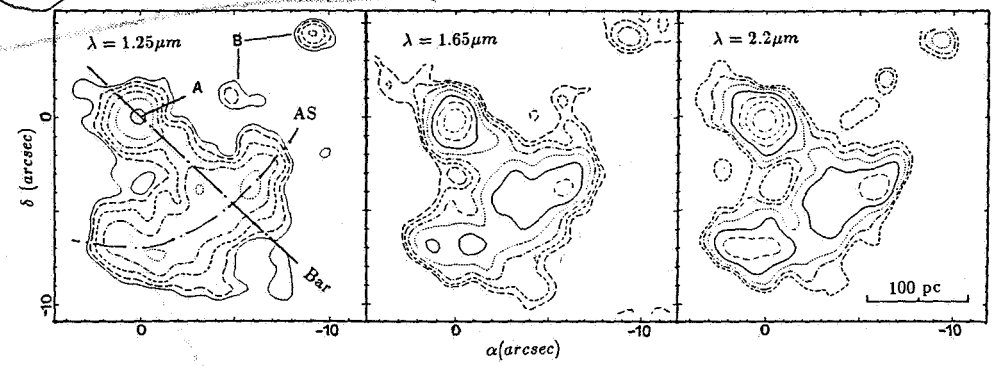
In external galaxies, near-infrared emission originates from stellar populations, hot dust, free-free emission from H^+ regions, gaseous emission, non-thermal nucleus if any. Because of the low extinction compared to the visible, infrared wavelengths are useful to probe regions obscured by dust such as central parts where *starburst* phenomena can occur because of the large quantity of matter.
The results presented below were obtained with a 32×32 InSb CID array cooled at 4K, at the f/36 cassegrain focus of the 3m60 Canada-France-Hawaii telescope with a spatial resolution of 0.5" per pixel[1,2].
The objects presented below are spiral barred galaxies mapped at J($1.25\mu m$), H($1.65\mu m$) and K($2.2\mu m$). The non-axisymetric potential due to the presence of a bar induces dynamical processes leading to the confinement of matter and peculiar morphologies. Infrared imaging is used to study the link between various components. Correlations with other wavelengths ranges and 2-colors diagrams ([J-H],[H-K]) lead to the identification of star forming regions, nucleus. Maps show structures connected to the central core, are they flowing away or toward the nucleus ?



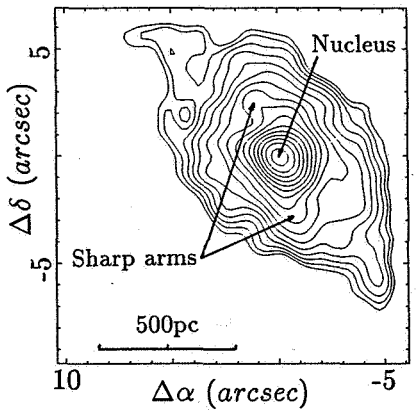
Isophotes maps of NGC 5236 at J, H and K. Region A (nucleus), B ($6cm/10\mu m$ peaks) and AS (arc-like structure) are quoted on the J map; direction of the bar is also drawn. Contours are separated by 0.5 $mag/arcsec^2$, lowest contours are 16.5 $mag/arcsec^2$.

M83 is the nearest barred spiral located at a distance of 3.75 Mpc. It features an "amorphous" nuclei at visible wavelengths[3,4] while infrared maps show a rather complex structure.

- A point-like source, which has typical color indices of a normal stellar nucleus, reddening by $A_v = 2$ and mixed with gaseous content.
- An arc-like structure, at 120 pc of the nucleus, showing a patchy distribution and extending from south-east to north. Southern color indices are characteristic of a giant and/or supergiant population while northern ones reveal the presence of gas.
- At north, a point-like source correlated with a low flux level source to radio and $10\mu m$ peaks[5,6] characterizes a starburst region.

From these observations, several conclusions result:

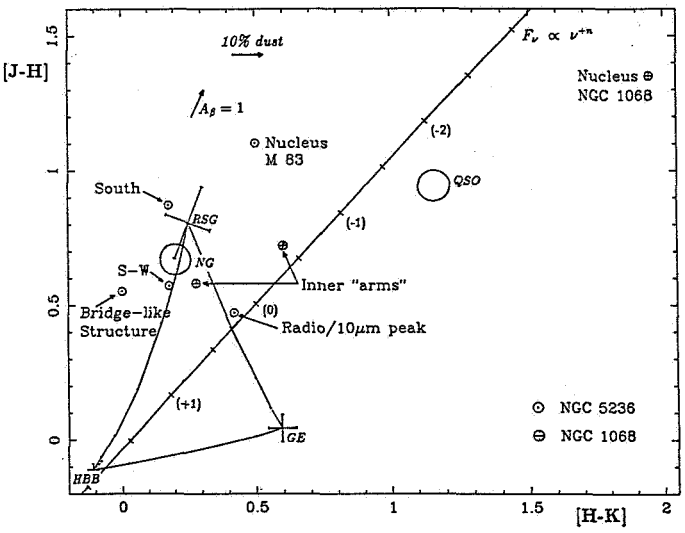
- The star forming region, detected in the visible and the infrared cannot be very compact and must extend to the edge of the matter concentration.
- The general shape of the near-infrared emission and the location of radio and $10\mu m$ peaks suggest the confinement of matter between the inner Linblad resonances localized from CO measurements about 100 and 400 pc.
- The distribution of color indices in the arc from southern part to the star forming region suggests an increasing amount of gas and a time evolution eventually triggered by super nova explosions.
- Close to the direction of the bar, a bridge-like structure connects the arc to the nucleus with peculiar color indices. Peharps, this structure can be linked to a hight velocity component seen in UV[7] and we can attribute it to a "jet"[8] and/or a matter flow along the bar toward the nucleus, fuelling it[9].



Isophotes map of NGC 1068 at J. Contours are separated by 0.25 $mag/arcsec^2$, the lowest contour is 16.5 $mag/arcsec^2$.

NGC 1068 is the nearest Seyfert 2 galaxy. It has been subject of many studies at all wavelengths. This object was mapped at J, H, K, L and M, and in polaro-imagery.

- No infrared counterpart to the radio jet, however a small structure is present at the north of the nucleus.
- Color indices of the nucleus are typical of quasar, if we assume that a hot dust component contributes to the emission. This agrees with the assumption of an obscured Seyfert 1 nucleus.
- A strong stellar bar oriented north-east/south-west.
- Two sharp arms linked to the nucleus, starting from north to north-east and south to south-west oriented in the direction of the bar. Color indices are those of a stellar component with contribution of ionized gas.



Two-colors diagram (J-H)/(H-K).
⊙ and ⊕ refer respectively to NGC 5236 and NGC 1068. The colors of three possible infrared contributors, red super giants (RG), gaseous emission (GE) and a 42500K blackbody (HBB) are plotted joined by mixed lines (from Campbell and Terlevich, 1984[10]). Straight line represents colors of a power-law with various spectral indices and filled circles represent the area populated by "normal" galaxies (NG) and quasars (QSO).

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