Outline

- Infrared vision technique: *chopping and nodding*
- Work description
  - Input data
  - Pre-processing
  - Mosaicing
  - Results
- Conclusions
- Future work
Chopped and nodded imaging

CHOPPING of \( K^+ \)

NODDING of \( K^- \)

\[
\text{Beam } A \\
\text{Beam } B_{k^+} \\
\text{Beam } B_k
\]

\[
\text{Beam } A \\
\text{Beam } B_{k^+} \\
\text{Beam } B_k
\]

CHOPPED & NODDED IMAGE

\[
(A - B_{k^+}) - (B_k - A)
\]
Chopped and nodded imaging

CHOPPING of $K^+$

NODDING of $K^-$

CHOPPED & NODDED IMAGE

$(A - B_{k+}) - (B_{k-} - A)
Input data

- The Orion nebula
- The observations
- Data features
- The environment
The Orion nebula

Our data parameters:

wavelength: 10μm and 20μm

27<sup>th</sup> and 28<sup>th</sup> of November 1998 images
18<sup>th</sup> and 19<sup>th</sup> of December 2000 images

(1)-(2)-(3): Becklin-Neugebauer
(4)-(5)-(6): Trapezium
(7): θ1C
Our observations at 10μm

The Hubble Image

UKIRT December 2000

UKIRT November 1998

Anna Custo

Baltimore, May 2001
Our observations at 20µm

UKIRT December 2000

The Hubble Image
Pre-processing

- Creating the chopped and nodded image
- Image cleaning (see appendix B)
- Studying the fits headers

Alignment

- Offset creations criteria
- Control file creation: shifting parameters for the best alignment
- Data exclusion
- Offset files creation

Microsoft Excel - inf10mic_comm.xls

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NAME</td>
<td>POS</td>
<td>RA</td>
<td>DEC</td>
<td>OFSTx pix</td>
<td>OFSTy pix</td>
<td>OFSTx arc</td>
<td>OFSTy arc</td>
<td>dx</td>
<td>dy</td>
</tr>
<tr>
<td>2</td>
<td>ab1514</td>
<td>main</td>
<td>5:35:21.8</td>
<td>-5:22:11.3</td>
<td>180.36578</td>
<td>479.38156</td>
<td>48.696764</td>
<td>124.6392</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>ab1516</td>
<td>main</td>
<td>5:35:23.4</td>
<td>-5:22:11.1</td>
<td>87.395793</td>
<td>480.14308</td>
<td>23.596662</td>
<td>124.0372</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>ab1518</td>
<td>main</td>
<td>5:35:21.8</td>
<td>-5:22:11.3</td>
<td>180.36578</td>
<td>479.38156</td>
<td>48.696764</td>
<td>124.6392</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>ab1520</td>
<td>main</td>
<td>5:35:23.4</td>
<td>-5:22:11.1</td>
<td>87.395793</td>
<td>480.14308</td>
<td>23.596662</td>
<td>124.0372</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>ab1522</td>
<td>main</td>
<td>5:35:25.1</td>
<td>-5:22:10.9</td>
<td>-5.3751392</td>
<td>480.90463</td>
<td>-1.4512877</td>
<td>125.0352</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>ab1524</td>
<td>main</td>
<td>5:35:25.1</td>
<td>-5:21:45.9</td>
<td>-5.3751392</td>
<td>480.90463</td>
<td>-1.4512877</td>
<td>125.0352</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>;ab1526</td>
<td>main</td>
<td>5:35:23.4</td>
<td>-5:21:45.1</td>
<td>87.395763</td>
<td>576.30454</td>
<td>23.596662</td>
<td>149.8392</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>ab1528</td>
<td>main</td>
<td>5:35:21.8</td>
<td>-5:21:46.3</td>
<td>180.36578</td>
<td>576.5431</td>
<td>48.696764</td>
<td>149.8392</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>;ab1530</td>
<td>main</td>
<td>5:35:20.1</td>
<td>-5:21:45.5</td>
<td>273.33578</td>
<td>574.78156</td>
<td>73.800665</td>
<td>149.4432</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>;ab1532</td>
<td>main</td>
<td>5:35:18.4</td>
<td>-5:21:46.7</td>
<td>366.30569</td>
<td>574.02002</td>
<td>98.902566</td>
<td>149.2452</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>ab1554</td>
<td>main</td>
<td>5:35:16.7</td>
<td>-5:21:49.9</td>
<td>469.27579</td>
<td>573.25646</td>
<td>124.00447</td>
<td>149.0472</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>13</td>
<td>ab1536</td>
<td>main</td>
<td>5:35:15.0</td>
<td>-5:21:47.1</td>
<td>552.24579</td>
<td>572.49684</td>
<td>143.10367</td>
<td>148.8492</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>ab1538</td>
<td>main</td>
<td>5:35:13.3</td>
<td>-5:21:47.3</td>
<td>645.21579</td>
<td>571.74925</td>
<td>174.20627</td>
<td>146.6540</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>ab1540</td>
<td>main</td>
<td>5:35:11.5</td>
<td>-5:21:47.5</td>
<td>745.55172</td>
<td>570.98771</td>
<td>201.25897</td>
<td>148.4568</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>16</td>
<td>ab1542</td>
<td>main</td>
<td>5:35:09.9</td>
<td>-5:21:47.7</td>
<td>830.32264</td>
<td>570.22617</td>
<td>225.34712</td>
<td>146.2560</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>17</td>
<td>ab1544</td>
<td>main</td>
<td>5:35:13.2</td>
<td>-5:21:47.3</td>
<td>652.55172</td>
<td>571.74925</td>
<td>175.19707</td>
<td>146.6548</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>18</td>
<td>ab1546</td>
<td>main</td>
<td>5:35:14.9</td>
<td>-5:21:47.1</td>
<td>559.61172</td>
<td>572.51079</td>
<td>151.05517</td>
<td>146.6520</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Mosaicing

Mosaic by offset: the old technique

Raw Mosaic data structure

Math Mosaic data structure
Mosaicing

Mosaic by offset: the new automatic technique

Data set
(set of fits files 128x128 px)

MkOfst_by_info.pro
Restoration

The Landweber loop and the median filter

The Original Image

The restoration /w the median filter

The original restoration

The median filter after the restoration
Restoration II

The three layers

Their composition

MkBest.pro

December 2000
Our results

Past Results

New Results
Conclusions

• Main astronomical goals achieved
• What we learned:
  § Basic rules for future observations (alignment)
  § Parameters of interest (K, IT, Right Ascension, Declination)
  § Critical aspects (different K)
• Problems to be solved:
  § Better filter technique
  § More accuracy in the combination methods
  § Portability of the new procedures
  § More automation
The Munich conference

Mid-IR emission of circumstellar disks in the Orion Nebula

M. Robberto, S. V. W. Beckwith, N. Panagia (Space Telescope Science Institute, Baltimore, USA)
T. M. Bert contracted, S. Legget (Max Planck Institute for Astronomy, Heidelberg, Germany)
M. Bertero, P. Boccaletti, A. Custo (Dipartimento di Scienze dell’Informazione, Genova, Italy)

ABSTRACT

We present results from an extensive study of the Orion Nebula at mid-IR wavelengths performed with the MAX survey on UKIRT. The data include spectroscopic and field images at 100 and 140 μm and large images of 24-μm emission, addressing the effects of the nebular environment on the disk thermal emission is also presented.

1. Wide field imaging of the Orion Nebula

2. Deep survey of selected fields

3. The IR SED of disks in a HH region

At the Munich conference (April 2001) we presented the restored image of the Orion nebula supporting the STScI group’s thesis about the circumstellar disks.
Future work: the simulator

- Goals
  - Automation
  - Pattern creation
  - New technique testing
- Description
- Features
- Advantages
  - Useful tool for astronomer
  - User-friendly interface
  - Easy testing
Appendix A: MkBest

Chop Distance $K$ 93 px

Create the masks in order to compute the right weights

The result image of the merge algorithm

$K$ 36 px

$K$ 70 px
Appendix A: MkBest

Mask with ghosts each 93 px

Mask (36 px)

Merge with the right weights

The result image of the merge algorithm
Appendix B: cleaning

• Image cleaning
  § cosmic ray (1)
  § bad columns and rows (2)
  § bad deep columns and rows (3)
  § bad channels (4)
Appendix B: cleaning

- Cosmic ray (1)
Appendix B: cleaning

- Bad columns and rows (2)

In questo gruppo di immagini vediamo tre fasi della pulizia di un frame:
- nei rettangoli di fig.1: bad column
- nel cerchio di fig.2: bad pixel.
Appendix B: cleaning

- Bad columns and rows (3)
Appendix B: cleaning

- Bad channels (4)