Hints of a spiral structure in the innermost regions around IRC+10216

G. Quintana-Lacaci

Pacific Rim, Hong Kong, 14th Dec 2015
Metals in IRC +10216: Single dish


Letter to the Editor

Metals in IRC +10216: detection of NaCl, AlCl, and KCl, and tentative detection of AlF

J. Cernicharo\textsuperscript{1,2} and M. Guélin\textsuperscript{1}

\textsuperscript{1} IRAM, Domaine Universitaire de Grenoble, voie 10, F-38406 St. Martin d’Hères, France
\textsuperscript{2} Groupe d’Astrophysique de l’Observatoire de Grenoble, USTMG, CERMO, BP 68, F-38402 St. Martin d’Hères Cedex, France

Received June 25, accepted July 7, 1987
Metals in IRC+10216: Single dish

Agúndez et al. 2012
Metals in IRC+10216: Single dish

HIFI – Cernicharo et al. (in preparation)
# Metals as seen by ALMA

<table>
<thead>
<tr>
<th>Molecule</th>
<th>Trans.</th>
<th>Freq (MHz)</th>
<th>Beam</th>
<th>Setup</th>
</tr>
</thead>
<tbody>
<tr>
<td>NaCl</td>
<td>20–19</td>
<td>260223.113</td>
<td>0′′867 × 0′′563</td>
<td>5</td>
</tr>
<tr>
<td>NaCl</td>
<td>21–20</td>
<td>273202.100</td>
<td>0′′704 × 0′′516</td>
<td>3</td>
</tr>
<tr>
<td>NaCl v=1</td>
<td>20–19</td>
<td>258287.756</td>
<td>0′′758 × 0′′606</td>
<td>6</td>
</tr>
<tr>
<td>NaCl v=1</td>
<td>21-20</td>
<td>271170.047</td>
<td>0′′711 × 0′′514</td>
<td>3</td>
</tr>
<tr>
<td>Na^{37}Cl</td>
<td>21–20</td>
<td>267365.814</td>
<td>0′′709 × 0′′551</td>
<td>4</td>
</tr>
<tr>
<td>KCl</td>
<td>34–33</td>
<td>260916.468</td>
<td>0′′866 × 0′′561</td>
<td>5</td>
</tr>
<tr>
<td>KCl</td>
<td>35–34</td>
<td>268558.984</td>
<td>0′′705 × 0′′549</td>
<td>4</td>
</tr>
<tr>
<td>K^{37}Cl</td>
<td>35–34</td>
<td>260939.948</td>
<td>0′′865 × 0′′561</td>
<td>5</td>
</tr>
<tr>
<td>K^{37}Cl</td>
<td>36–35</td>
<td>268363.909</td>
<td>0′′706 × 0′′549</td>
<td>4</td>
</tr>
<tr>
<td>AICl</td>
<td>18–17</td>
<td>262219.282</td>
<td>0′′863 × 0′′559</td>
<td>5</td>
</tr>
<tr>
<td>Al^{37}Cl</td>
<td>18–17</td>
<td>256063.773</td>
<td>0′′764 × 0′′611</td>
<td>6</td>
</tr>
<tr>
<td>Al^{37}Cl</td>
<td>19–18</td>
<td>270269.445</td>
<td>0′′714 × 0′′515</td>
<td>3</td>
</tr>
<tr>
<td>AlF</td>
<td>8–7</td>
<td>263749.390</td>
<td>0′′858 × 0′′557</td>
<td>5</td>
</tr>
</tbody>
</table>

**Cycle 0 - BAND 6 Observations**
Metals as seen by ALMA
Cycle 0 - BAND 6 Observations
Metals as seen by ALMA

Cycle 0 - BAND 6 Observations

Watch out for this!
Metals as seen by ALMA

$\text{Al}^{37}\text{Cl} \ 18-17$
Metals as seen by ALMA

NaCl 21-20
Metals as seen by ALMA

NaCl & Kcl emissions
Metals as seen by ALMA

Al-bearing emission
Spiral Fitting

Spiral fitting

Mass = $1.0 \times 10^{22}$ gr = $1.7 \times 10^{-6} M_{\text{earth}}$

$R_{\text{in}} = 27$ au
Metals in IRC+10216: Single dish

HIFI – Cernicharo et al. (in preparation)
Other Structures: Outflow

Haniff & Buscher, 1998
NIR (K: 2.2um and L:3.4um)
Other Structures: Outflow

Weigelt et al., 1998

K' band (2.17 um)
Other Structures: Outflow

Weigelt et al., 2002
NIR (JHK)
Other Structures: Shells

Mauron and Huggins, 1999
B and V Bands
Other Structures: Dust Lane

Tuthill et al., 2000
K Band
Other Structures: Dust Lane

Jeffers et al. 2014
Other Structures: Dust Lane

Jeffers et al. 2014
Rotation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rin</td>
<td>0°'2</td>
</tr>
<tr>
<td>i</td>
<td>15°</td>
</tr>
<tr>
<td>P.A.</td>
<td>120°</td>
</tr>
<tr>
<td>$V_{\text{exp}}$</td>
<td>11 km/s</td>
</tr>
<tr>
<td>$V_{\text{rot}}$</td>
<td>8 km/s</td>
</tr>
</tbody>
</table>
Conclusions

We found an elongation with a P.A.~ 76° visible in NaCl and KCl

Not seen in Al-bearing molecules – Dipole moment

NaCl and KCl are good tracers of high-density regions

Conciliate the dark lane: rotation + 15° tilt

Orthogonal with the 20° outflow

A Rotating Spiral

Cycle 2...
Cycle 2 – Compact conf. + Short spacing

Extended conf. on the way (~0.6")

Metals @ 3mm
HPBW ~ 4” x 3”