DUST PROPERTIES OF MOLECULAR CLOUDS: A CASE OF NGC 604 AND GMC 16

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Abstract

This study investigates the dust properties of molecular clouds in (M33) with a special focus on two giant molecular clouds (NGC 604 and GMC 16), using a calibrated data source from Atama Large Millimeter Array (ALMA) Band 6. Using the Astrodendro of dendrogram analysis we identified three millimeter sources (MMS) in NGC 604 and one millimeter source (MMS) in GMC 16, we estimated dust mass and gas mass in both regions, with a dust temperature of 22K and gas-to-dust ratio of 200, yielding a dust masses of approximately 1.5×10^{-1} solar masses, for a molecular clouds in M33. This analysis incorporates methodologies from literature reviews to compare dust mass estimates and explore correlations between dust in the Milky Way and Nearby galaxies.

1. Introduction

- **M33**: Nearby spiral galaxy ideal for resolving GMCs
- **NGC 604**: Most luminous HII region in M33
- **GMC 16**: Intermediate stage molecular cloud evolution

2. Methodology

- **Data**: Archival ALMA Band 6 (1.3 mm), **Temp**: 22 K, **GDR**: 200.
- **Tools**: CASA, and Python.

Dust Mass Calculation:

$$M_d = \frac{F_\nu D^2}{\kappa_\nu B_\nu(T)}$$

3. Results: Source Identification

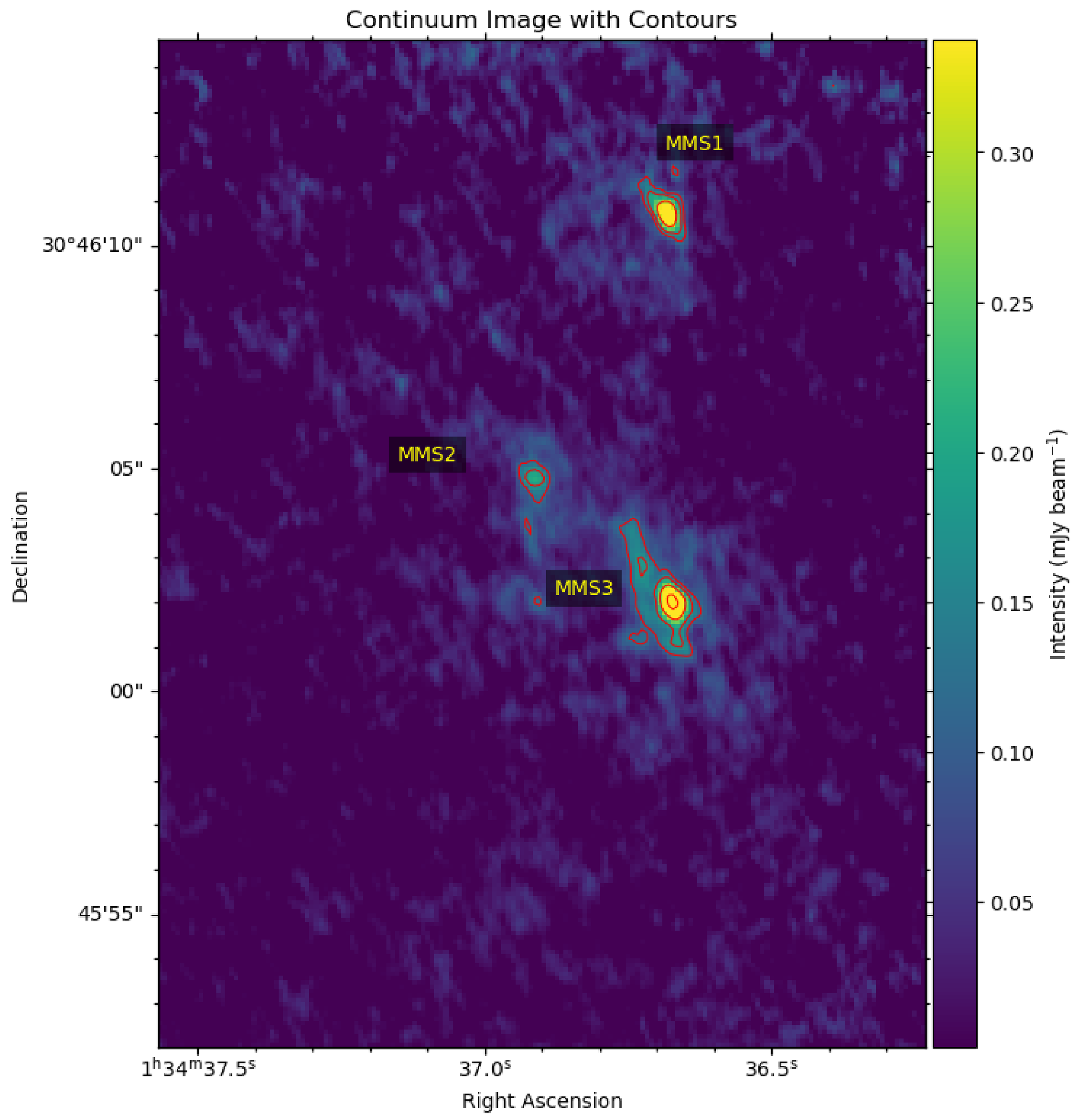

Figure 1: NGC 604 of ALMA Band 6 of 12m array, three sources are detected, namely: MMS1, MMS2, and MMS3

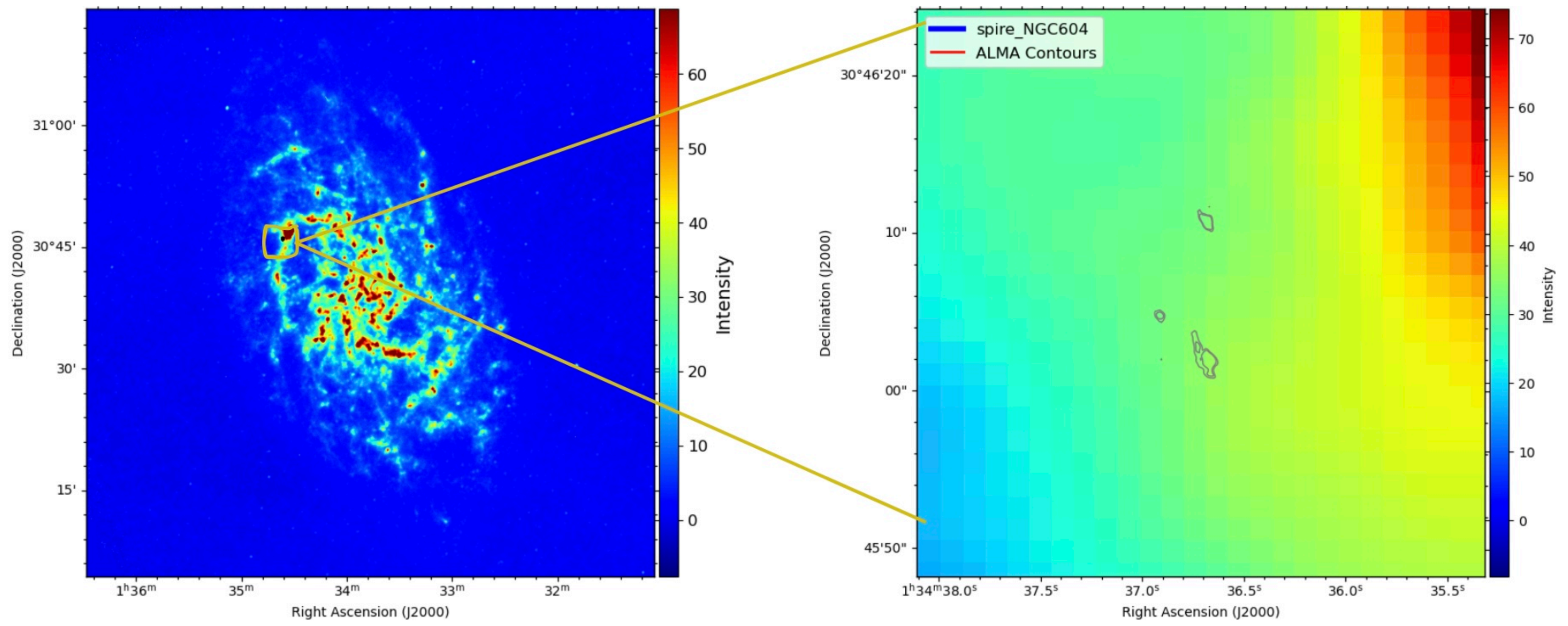

Figure 2:Left: A map of the NGC 604 complex of 250 µm from Herschel/SPIRE. Right: a zoomed-in view of the central molecular complex of ALMA 12m array contours overlaid.

4. Quantitative Analysis

Region	$M_d\ (M_\odot)$	$M_{gas}\ (M_\odot)$
NGC 604 (MMS1)	1.15×10^2	2.31×10^4
GMC 16	1.91×10^1	3.81×10^3

Note: NGC 604 loading is significantly enhanced by high-pressure environments.

5. Conclusion

This study shows that the Dust properties of Molecular clouds in M33 is similar to those in the Milky Way despite their different environments.

References

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