# Can Galactic GMCs be Identified from $l$-v Diagrams?

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Identifying the spiral nature of the distribution of gas in the Galaxy has been a subject of much research in the past thirty years. The position of the sun in the disk of the Galaxy presents us with a problem of perspective: how does one identify the cloud system from within the system? Longitude-velocity ($l$-v) diagrams have been used to try to determine the distribution of interstellar gas, but problems inherent in the methods have been pointed out previously (Burton 1971). Recent Galactic CO surveys have been used in attempts to map the distribution of molecular cloud complexes in the disk of the Galaxy (Dame, *et al.* 1986). Here, we use numerical simulations of the molecular cloud system in a spiral galaxy to consider the following question: to what extent can concentrations of emission in the $l$-v diagram (LVCs) be considered complexes of gas in the disk of the Galaxy (GMCs)?

The galactic disk used here is from the models of Roberts and Hausman (1984), with 20,000 particles representing gas clouds orbiting in a spiral perturbed, galactic gravitational potential. The observer's reference point is placed at a galactocentric radius of 10 kpc between major spiral arms. An $l$-v diagram is then created for all clouds in the first quadrant of the model galaxy. Clouds are binned in the $l$-v diagram with a cell size of $\Delta l_{cell}$=0.25° and $\Delta v_{cell}$=1.25 $km\ sec^{-1}$.

A clipping method (Dame, *et al.* 1986) is used to reduce the background emission of clouds not belonging to complexes. For a clipping level of $c$=1, each cell with a density of one cloud per cell (or less) is considered background and set to a density of zero clouds/cell. Thus every cell with a density of 2 clouds/cell and above is considered to be part of an LVC. Neighboring cells that meet the clipping criterion are considered to be part of the same LVC.

The fifteen largest LVCs (labelled A-O) for a clipping of $c$=1 are displayed in Figure 1. When the clouds belonging to these LVCs are plotted spatially (Figure 2), we see that what appear as complexes in the $l$-v plane are not necessarily complexes in the disk. Investigation of any one LVC shows that it is made up of clouds that are spread out along the entire line of sight. The same effect can be seen for different clipping levels.

The net result is that apparent clumping in the $l$-v plane can be misinterpreted



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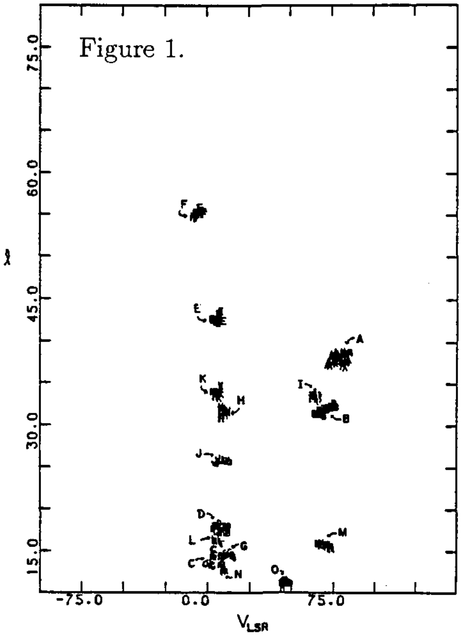


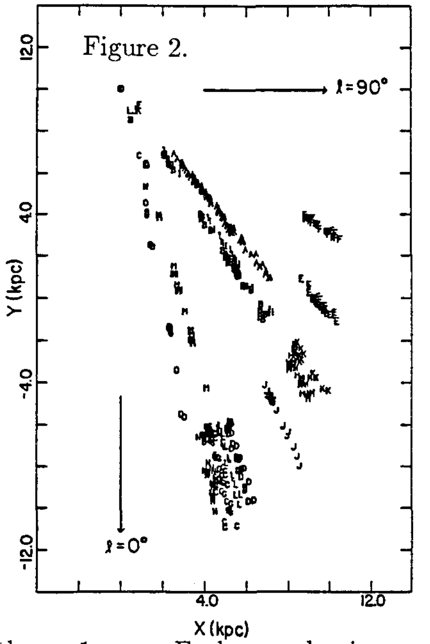


Figure 1. The fifteen largest complexes for the $c$=1 case. Each complex is represented by a letter, A-O.

Figure 2. The spatial distribution for the LVCs in the $c$=1 case. The lettering scheme for the separate complexes is consistent with Figure 1. The observer's reference point is marked with a circle; lines of $l = 0°$ and $l = 90°$ are marked.

unless care is taken. This was first pointed out by Burton (1971), who demonstrated that certain geometrical effects appear in $l$-v digrams no matter what parameters are used. He also pointed out the importance of including streaming motions in rotation curves when determining kinematic distances of clouds.

We conclude that the current method of determining molecular cloud complexes from the analysis of the $l$-v diagram is not reliable. The unfortunate circumstance of being located in the disk of the Galaxy makes it exceedingly difficult, if not downright impossible, to determine the distribution of molecular cloud complexes with the data currently available.

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