abstract

We present the first interferometric map of the entire disk of M33. The 13'' diameter synthesized beam corresponds to a linear resolution of 50 pc, sufficient to distinguish individual giant molecular clouds (GMCs). From these data we generated a catalog of 148 GMCs with an expectation that no more than 15 of the sources are spurious. The catalog is complete down to GMC masses of $1.5 \times 10^{5} M_{\odot}$ and contains a total mass of $2.3 \times 10^{7} M_{\odot}$. Single dish observations of CO in selected fields imply that our survey detects $\sim 50\%$ of the CO flux, hence that the total molecular mass of M33 is $4.5 \times 10^{7} M_{\odot}$, approximately 2% of the mass. The GMCs in our catalog are confined largely to the central region ($R < 4 \text{kpc}$). They show a remarkable spatial and kinematic correlation with overdense filaments; the geometry suggests that the formation of GMCs follows that of the filaments. The GMCs exhibit a mass spectrum $dN/dM \propto M^{-2.6\pm0.3}$, considerably steeper than that found in the Milky Way and in the LMC. Combined with the total mass, this steep function implies that the GMCs in M33 form with a characteristic mass of $\sim 7 \times 10^{4} M_{\odot}$. More than 2/3 of the GMCs have associated H$_{2}$ regions, implying that the GMCs have a short quiescent period. Our results suggest the rapid assembly of molecular clouds from atomic gas, with prompt onset of massive star formation.