

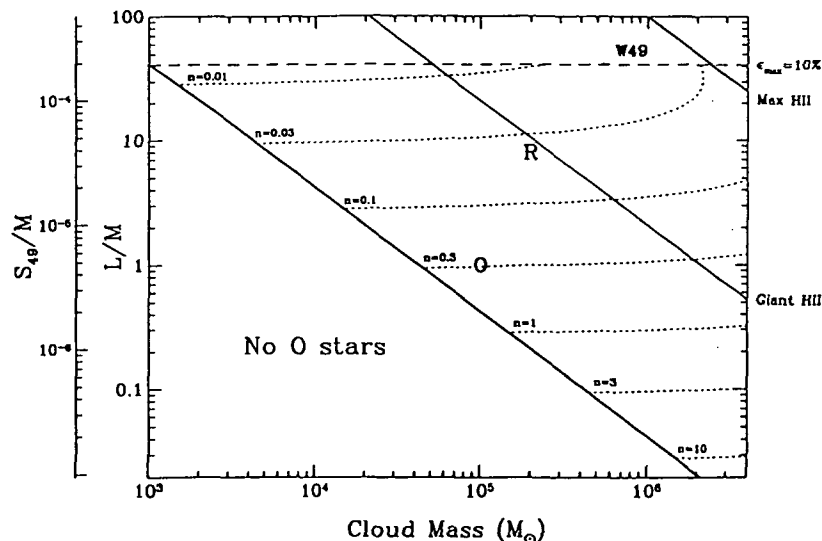
OB associations and Giant Molecular Clouds in the Galaxy

Jonathan Williams, Chris McKee
 University of California, Berkeley

Giant molecular clouds (GMCs) are the sites of all OB star formation in the Galaxy. These OB stars typically form in large associations and photoionize the surrounding gas, eventually destroying the clouds from which they were born. CO surveys have revealed the distribution of GMCs in the Galaxy, and radio observations provide data on the distribution of associations. These results are extrapolated to determine Galactic mean distribution functions of each and then combined to determine how GMCs and OB associations are correlated.

The resulting probability distribution of luminosity given cloud mass implies that although most of the molecular mass of the Galaxy is in massive star forming complexes, a large number of clouds are in a quiescent state, not forming massive stars. There is a threshold mass for molecular clouds above which massive star formation is extremely likely and abundant and below which it is almost certainly absent.

H α observations of extra-galactic HII regions can be characterized in the same manner. Whilst we find that the form of the luminosity distribution of different Hubble types is similar to that of the Galaxy, we note that the maximum luminosity of OB associations in early type galaxies appears to be limited by some physical process absent in later type galaxies. However there is a definite limit to the mass of the largest GMCs for both types (otherwise the largest cloud would contain half the mass of the galaxy!), and we find that the basic conclusions drawn about the proportion of star forming GMC's is rather insensitive to the form of the GMC mass spectrum implying that the diagram below for the Galaxy may be qualitatively similar to what might be found for other spirals.



Luminosity per mass of O star associations against mass for the Galactic HII luminosity distribution and GMC mass spectrum. S_{49} is the ionizing photon luminosity in units of 10^{49} photons/sec. The solid diagonal lines are lines of constant luminosity and the dotted lines are contours of expected number of associations, as a function of luminosity and mass (if less than one it is interpreted as a probability). The Orion, Rosette and W49 HII regions are included on the diagram as examples.