Radiation pressure dominated HII regions
Sherry C. C. Yeh & Christopher D. Matzner
University of Toronto

Summary
HII regions are often idealized by having homogeneous ionized gas filling the entire region. However radiation pressure shall play a vital role in affecting HII region dynamics when the central ionizing source contains many early O-type stars (Krumholz & Matzner 2009). We use the photoionization code Cloudy to investigate the electron density profile of an HII region. The parameter space $R_{st}/R_{in}$ v.s. $R_{l}/R_{in}$ is used to describe the HII dynamics in each Cloudy experiments. An HII region is radiation dominated when $R_{st}/R_{in}>1$ and $R_{l}/R_{in}>1$ even when the ionizing source is less powerful. The density profile represents a regular HII region otherwise.

In each dusty Cloudy simulation, we varied the inner radius ($R_{in}$) of the cloud and obtained the normalized electron density profile ($n/n_i$) as a function of the normalized depth in the cloud ($d/d_i$). When $R_{in}$ is smaller than the Strömgren radius $R_{st}$ and the characteristic radius $R_{l}$ (zone 4 & 5), the ionized gas is confined and squashed into a thin layer with much higher density than predicted (Draine 2010), and this is also seen in the case with 1 B0 star. When $R_{in}$ is greater than $R_{st}$ and $R_{l}$ (zone 1 to 3 and zone 6), it mimics the inflation of an inner bubble by stellar winds. In this case, the density profile represents a regular HII region, regardless the type of the ionizing source (cf. Draine 2010).

On-going work: The ultimate goal of this project is to use the ionization parameter $U$ as a diagnostic of radiation pressure dominated HII region. We are working on evaluating $U$ from line ratios calculated by Cloudy, and we will compare the values with the observed ones in starburst regions such as 30 Doradus and M82.