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Formation of structures around HII regions: ionization feedback from massive stars

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Abstract. We present a new model for the formation of dense clumps and pillars around HII regions based on shocks curvature at the interface between a HII region and a molecular cloud. UV radiation leads to the formation of an ionization front and of a shock ahead. The gas is compressed between them forming a dense shell at the interface. This shell may be curved due to initial interface or density modulation caused by the turbulence of the molecular cloud. Low curvature leads to instabilities in the shell that form dense clumps while sufficiently curved shells collapse on itself to form pillars. When turbulence is high compared to the ionized-gas pressure, bubbles of cold gas have sufficient kinetic energy to penetrate into the HII region and detach themselves from the parent cloud, forming cometary globules.

Using computational simulations, we show that these new models are extremely efficient to form dense clumps and stable and growing elongated structures, pillars, in which star formation might occur (see Tremblin *et al.* 2012a). The inclusion of turbulence in the model shows its importance in the formation of cometary globules (see Tremblin *et al.* 2012b). Globally, the density enhancement in the simulations is of one or two orders of magnitude higher than the density enhancement of the classical "collect and collapse" scenario. The code used for the simulation is the HERACLES code, that comprises hydrodynamics with various equation of state, radiative transfer, gravity, cooling and heating.

Our recent observations with Herschel (see Schneider *et al.* 2012a) and SOFIA (see Schneider *et al.* 2012b) and additional Spitzer data archives revealed many more of these structures in regions where OB stars have already formed such as the Rosette Nebula, Cygnus X, M16 and Vela, suggesting that the UV radiation from massive stars plays an important role in their formation. We present a first comparison between the simulations described above and recent observations of these regions.

Keywords. methods: numerical, methods: data analysis, ISM: globules, ISM: HII regions, ISM: kinematics and dynamics

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