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# Infrared emission and dust dynamics in expanding HII regions

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Massive stars signpost places of their birth in molecular clouds with expanding HII regions and photodissociation regions (PDRs). The HII regions and PDRs have very specific observational manifestation on *Spitzer* images. Namely, the ring-like structures which are seen at 8 micron surround the inner regions which are bright at 24 micron. The ring-like structures are also seen on *Herschel* images at longer wavelengths. This can be related to the properties of dust particles which are not the same inside and outside of HII regions. We present new results of a long-term theoretical study of expanding HII regions in order to understand what happens with the dust particles near young massive stars and how HII regions and PDRs look during their evolution around massive stars. We consider the drift of charged dust under the influence of radiation pressure, Coulomb drag and the lug of dust by gas simultaneously during the expansion of an HII region. Dust particles are represented by the polycyclic aromatic hydrocarbons (PAHs) and an ensemble of silicate and graphite grains of larger sizes. We evaluated a grain charge evolution within the HII region for each dust type. We find that PAHs and intermediate-size silicates have the greatest impact on the gas dynamics. Dust-to-gas mass ratio within the HII region changes from initial canonical value up to 50-90% depending on a spectral type of the massive star. Big grains are effectively swept out of the HII region. Intermediate size grains have double-peaked distribution of radial density profile. Dynamics of charged grains allows us to qualitatively explain the emission in the HII region RCW 120. We show relative input of every dust grain type to the emission in the infrared wavelength range. Emission at 4–8 micron is produced by PAHs. Our simulations show that PAHs and smaller graphite grains are mostly coupled to the gas. Removal of PAHs from the HII regions is required to reproduce their ring-like appearance at 3.6–8 micron found by *Spitzer*. Photo-destruction of PAHs by strong ultraviolet emission produced by the central massive star can explain the depletion of PAHs in the HII region. Our study of a large sample of HII regions confirms that PAHs mass fraction is much lower in these objects than the average Galactic value, implying the effective destruction of aromatic particles in HII regions. We discuss how simultaneous fitting of dust emission at several *Spitzer* and *Herschel* images helps to constrain dust properties near young massive stars.

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