Detailed Photoionization Analysis of Chemodynamical Simulation Results for the Evolution of Dwarf Star-Forming Galaxies at an Age of 100 Myr

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During the modification of multicomponent photoionization models (MPhM) of nebular emission surrounding regions of active star formation, developed to analyze chemodynamical simulations of the evolution of a dwarf galaxy characterized by intense star-forming activity (which account for the age-dependent variations in chemical abundances, gas density, and temperature within the "superwind" region), a significant problem arises related to the treatment of the diffuse ionizing radiation (DIR) field within the nebular environment. Typically, the *Outward-only* approximation is employed for this purpose [1,2]. However, the inhomogeneous ionization structure of the nebular medium, as revealed by chemodynamical simulations of these objects, suggests that the presence of an ionization front in the equatorial sectors of the dwarf galaxy may be a numerical artifact caused by incorrect DIR calculation. In [3], a procedure for the detailed calculation of DIR within the framework of multicomponent photoionization modeling was proposed. The authors applied this method to an MPhM corresponding to an evolutionary age of 140 Myr. As expected, the resulting ionization structure in the equatorial sectors differs substantially from the one obtained using the *Outward-only* approximation.

In the present work, we compare the results of MPhM for an evolutionary age of 100 million years. The initial spatial maps of emissivity and opacity (MEO) for a wide range of photon energies (both continuum and line emission) were obtained using the *Outward-only* approximation with the Cloudy code [4]. These maps were subsequently used for a detailed calculation of the DIR field using the DiffRay code [3]. The updated MEOs were then employed to recalculate the MPhM using the Cloudy code, taking into account the DIR field precomputed by DiffRay. As a result, the obtained ionization structure differs significantly from the initial one (derived under the *Outward-only* approximation), underscoring the necessity of further Cloudy + DiffRay iteration cycles. Here we present the resulting ionization structure obtained after the second global iteration.

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4. G. Ferland, Hazy, a Brief Introduction to Cloudy, Version 08 (University of Kentucky Internal Report, 2008), 807 p.