[구IM-05] The Origins of the Warm Ionized Medium/Diffuse Ionized Gas

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It is known that the diffuse Hα emission outside of bright H II regions not only are very extended, but also can occur in distinct patches or filaments far from H II regions, and the line ratios of [S II] λ6716/Hα and [N II] λ6583/Hα observed far from bright H II regions are generally higher than those in the H II regions. These observations have been regarded as evidence against the dust-scattering origin of the diffuse Hα emission (including other optical lines), and the effect of dust scattering has been neglected in studies on the diffuse Hα emission. However, as opposed to the previous contention, the expected dust-scattered Hα halos surrounding H II regions are, in fact, in good agreement with the observed Hα morphology. We find that the observed line ratios of [S II]/Hα, [N II]/Hα, and He I λ5876/Hα in the diffuse ISM accord well with the dust-scattered halos around H II regions, which are photoionized by late O- and/or early B-type stars. We also demonstrate that the Hα absorption feature in the underlying continuum from the dust-scattered starlight ("diffuse galactic light") and unresolved stars is able to substantially increase the [S II]/Hα and [N II]/Hα line ratios in the diffuse ISM.

[구IM-06] Ortho-to-Para Ratio Studies of Shocked H_2 Gas Observed from Two Supernova Remnants IC 443 and HB 21

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We present the near-infrared spectra (2.5-5.0 um) of shocked H_2 gas, observed with the Infrared Camera onboard the satellite AKARI. Two supernova remnants, IC 443 and HB 21, were observed. IC 443 shows a hint of non-equilibrium ortho-to-para ratio (OPR): 2.4 (-0.2, +0.3). HB 21 also shows an indication of a potential non-equilibrium OPR: 1.8-2.0. These non-equilibrium OPRs are first reported for shocked H_2 gas at E(v,J) > 7000 K, as far as we are aware. We concluded that the non-equilibrium OPR probably originates from dissociative J-shocks, considering several factors such as the shock combination requirement, the line ratios, and the possibility that H_2 gas can form on grains with a non-equilibrium OPR. The difference in the collision energy of H atoms on grain surfaces would give rise to the observed difference between the OPRs of IC 443 and HB 21, if dissociative J-shocks are responsible for the H_2 emission. Our study suggests that shocked-then-cooled H_2 gas may play as a heat reservoir with the non-equilibrium OPR.