Understanding of Gas and Dust Properties in the Interstellar Medium from the Planck All-sky Survey

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The Planck all-sky survey provides us with enormous information about the dust in the interstellar medium. Thanks to the thin thermal emission in the submm and far-IR wavelengths, high dynamic range image of the dust opacity, temperature, and the spectral index have been revealed. Comparing them with those of the atomic (HI) and molecular gas from the CO data by the NANTEN survey, we found that gas and dust properties change significantly with the dust temperature. Particularly important discovery is that the HI gas in cold and dense clouds has significantly larger optical depth than unity, implying that the total amount of the interstellar HI gas has been remarkably underestimated. For the warm and diffuse clouds, the dust opacity derived from the 353 GHz Planck data is smaller than that expected from the HI column density, suggesting different grain size distribution from that of cold and dense cloud. We conclude that the gas and dust properties are under strong influence of the interstellar radiation field.