

Scattering cross sections of atmospheric gases calculated by resonance frequencies and oscillator strengths

Masanori Onishi[1]; Masayuki Watanabe[2]; Satoshi Sakai[3]

[1] Human and Environmental Studies, Kyoto Univ; [2] Human and Env. Studies, Kyoto Univ.; [3] Human and Environ. , Kyoto Univ

Why is the sky blue? The blue sky on the earth results from Rayleigh scattering. The atmosphere on the earth consists mainly of nitrogen and oxygen molecules. Which molecule has a bigger scattering cross section? It is known that nitrogen and oxygen molecules have almost the same scattering cross sections. Nitrogen molecule has little larger scattering cross section than that of oxygen molecule. On the other hand, the magnitude of scattering cross section is characterized by electronic excitation energy of a molecule. Energy level structure of oxygen molecule is very different from that of nitrogen molecule. Why do nitrogen and oxygen molecules have almost the same scattering cross sections, although energy level structures of these are very different? We calculated scattering cross sections from this viewpoint.

To reveal why nitrogen and oxygen molecules have almost the same scattering cross sections, although energy level structures of these are very different, we calculated scattering cross sections using oscillator strengths and resonance frequencies. This study shows that in both oxygen and nitrogen molecules, high energy continuous absorption band (corresponding to background dielectric constant) make a large contribution to scattering cross section, so nitrogen and oxygen molecules have almost the same scattering cross sections.