論文 / 著書情報
Article / Book Information

題目(和文)	銀河拡散光の観測による星間ダストの研究
Title(English)	Study of interstellar dust from measurements of Diffuse Galactic Light
著者(和文)	大西陽介
Author(English)	Yosuke Onishi
出典(和文)	学位:博士(理学), 学位授与機関:東京工業大学, 報告番号:甲第10395号, 授与年月日:2017年3月26日, 学位の種別:課程博士, 審査員:松原 英雄,河合 誠之,堂谷 忠靖,宗宮 健太郎,野村 英子,尾中 敬
Citation(English)	Degree:Doctor (Science), Conferring organization: Tokyo Institute of Technology, Report number:甲第10395号, Conferred date:2017/3/26, Degree Type:Course doctor, Examiner:,,,,,
学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

（博士課程）
Doctoral Program

論 文 要 旨

THESIS SUMMARY

専攻： Department of	基礎物理学	専攻	申請学位（専攻分野）： Academic Degree Requested	博士 Doctor of	（ 理学 ）
学生氏名： Student's Name	大西 陽介		指導教員（主）： Academic Advisor(main)	松原 英雄	
			指導教員（副）： Academic Advisor(sub)	河合 誠之	

要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

Diffuse Galactic Light (DGL) is the scattered starlight by interstellar dust grains in the Galaxy. DGL gives us crucial information on optical properties especially size of interstellar dust grains, because the scattering phenomena is the most efficient where its size is comparable to the wavelength of scattered light. To date, measurements of DGL were mostly carried out only in optical wavelength range, however they are insufficient to understand the optical properties of interstellar dust grains.

In this study, we have conducted near-infrared observations of diffuse clouds in high Galactic latitude (|b|~40°) at *I*-band (1.1 μm) and *H*-band (1.6 μm), and obtained high quality photometric data with a wide-field imager (3.67 x 3.67 deg^2) onboard Korean space telescope so-called Multi-purpose Infra-Red Imaging System (MIRIS), with the best accuracy sufficient to discuss on size of interstellar dust grains. Since the starlight is not only scattered but also absorbed by interstellar dust and re-emitted in the far-infrared, the near-infrared brightness correlates well with the far- infrared one. Thus, the DGL brightness was derived by correlating the near-infrared brightness with the far-infrared brightness observed with *IRAS* and DIRBE/*COBE* in a wide density range from blank field to dense dust cloud. In addition, by correlating the near-infrared brightness with the optical brightness taken from existing optical images, we derived an optical to near-infrared spectrum of DGL.

The derived DGL at 1.1 μm and 1.6 μm are different among the three observed field, which means the scattering property of interstellar dust grains is different even in similar Galactic latitude. To investigate the size of interstellar dust grains in detail, we firstly compared our result with model spectra of DGL which is generated by applying the conventional interstellar dust models incorporating sub-micrometer sized grains. However, the model spectra shows significantly bluer color than the measured DGL's even though anisotropic effect on scattering is taken into account. One possibility of discrepancy is underestimation of albedo in the dust models. In fact, higher near-infrared albedo has been suggested for several Galactic regions. Moreover,

measurements of interstellar extinction curve universally exhibited a flatter shape in 3 - 8 μm than the predicted one from the conventional dust model. These studies imply the existence of larger size grains than the models consider. Therefore, we need to improve the dust models with reconsideration of size distribution of interstellar dust.

In order to explain the measured DGL spectrum, we extended a popular existing dust model by invoking a population of micrometer sized grains (up to ~ 10 μm), and calculated the albedo and DGL spectrum concurrently taking account of the effects on the interstellar extinction curve, the thermal emission in the far-infrared and sub-milimeter wave. The predicted thermal emission and interstellar extinction were found to be consistent with the *Planck* observations and extinction curve. By the created models with a population of micrometer sized grains, DGL spectra is also calculated with two scattering models. One is the isotropic scattering model, and the another is anisotropic one that the dust grains are illuminated by an infinite homogeneous disk. Comparing with measured DGL, isotropic scattering model with micrometer sized grains is more favorable to explain the measured near-infrared DGL color (1.1 μm to 1.6 μm). This model also mostly agrees with optical to near-infrared color of DGL.

High photometric accuracy of our data also allowed us to apply the dark cloud method to constrain the Extragalactic Background Light (EBL) which is the integrated light from extragalactic sources. The dark cloud method is one observation technique which is advantageous for eliminating uncertainty of the Zodiacal Light (ZL) foreground by using the screening effect by a diffuse cloud to subtract the fore- ground. By applying dark cloud method, we obtained 1σ upper limit of the EBL brightness of 38.2 nW m^{-2} sr^{-1} at 1.1 μm, corresponding to the allowable minimum albedos. In other words, by assuming the integrated Galactic light from deep galaxy counts as the lower limit of EBL brightness, we determined the maximum albedo of the interstellar dust to be 0.7 at 1.1 μm, which is consistent with that from our created dust model with micrometer sized grains.