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DUST IN THE SMALL MAGELLANIC CLOUD

Progress Report

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DUST IN THE SMALL MAGELLANIC CLOUD

I. SUMMARY OF THE PROPOSAL

Observations of reddened stars in the Small Magellanic Cloud (SMC) indicate that the interstellar grains in that galaxy may show distinct optical properties from those in the Galaxy. We aim at ultimately determining the extinction law in the direction of these three objects, correlating the results with our polarimetric data and building dust models that fit both extinction and polarization.

In the last report, we discussed such extinction curves and the theoretical models we have developed to interpret the SMC extinction and polarization data. Details were presented in a preprint included with that report. In this report, we summarize our work towards another related paper which will describe the relevant data in detail.

II. ACTIVITIES DURING THIS PAST SEMESTER

We are concentrating our activities related to the project in preparing a second paper, in which we describe the data (optical polarization, UV extinction), the correlations with each other and other data for stars in the SMC and their implications for grain models in that galaxy. The authors are Magalhães, Rodrigues, Coyne and Piirola, i.e., the PI and the Co-I's in this NASA grant.

Specifically, in this second paper we are including the following discussion:

Observations

. Optical Polarization data on AZV 126, 211, 221, 398, 456 with MINIPOL, VATPOL, PISCO polarimeters; distinct runs, sky corrections, variability check of chosen stars.

. IUE UV extinction data

. Foreground polarization (FP); tests on influence of chosen FP on parameters

. Foreground UV Extinction

Discussion

. Optical polarization:

this work: first color measurements of SMC polarization

comparison with earlier, unfiltered data

P_{max}, λ_{max}, k (2- & 3-parameter fit)

Wavelength Dependence of Position Angle

Pmax vs. E(B-V)

k vs. λmax: SMC consistent with Wilking et al.?

[λmax] vs. [LMC's <λmax>]

λmax < λGalaxy; the case of AV456

R vs. lmax

comparison between SMC and HD62542

. UV extinction:

AZV 211, 398, 456, etc.

Extinction (F&M) Parameters and correlations between them

Visible vs. FUV

Comparison with Galaxy and LMC

Specific Objects:

AZV 211 &AZV 398 : small λmax, no UV bump

AZV 456: normal λmax, UV bump

. Interpretation:

previous SMC dust models

predictions from models which use Galactic exctinction and only vary C-abundance

λ_{max} in terms of grain size

Carbon stars vs. amorphous C vs. graphite

Grain Mantle vs. bump

PAH's and the SMC ISRF

Our main results are:

1. The wavelengths of maximum polarization, λ_{max}, in the SMC are generally smaller than the Galactic average.

2. A notable exception is AZV 456, a star which incidentally has an extinction curve resembling the Galactic extinction curve. Its λ_{max} is also close to the average Galactic λ_{max} value.

3. There are significant differences in the SMC wavelength dependencies of extinction and polarization as compared to the Galaxy. AZV 456, for instance, has a bump at bluer wavelengths than the Galaxy and its wavelength dependent polarization is narrower than expected for its λ_{max} value.

Our UV extinction and optical polarization data, together with earlier UV data, suggest that stars with the 'typical' SMC extinction, i.e., with no UV bump, have λ_{max} smaller than the Galactic average. This shows that the Carbon abundance is not the only parameter distinguishing the dust properties for the Galaxy and the SMC, the grain size distribution being another distinction factor.

São Paulo, April 27, 1994 Antonio Mário Magalhães