The Local Interstellar Ultraviolet Radiation Field

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I have used the Hipparcos Input Catalog, together with Kurucz model
stellar atmospheres, and information on the strength of the interstellar
extinction, to create a model of the expected intensity and spectral dis-
tribution of the local interstellar ultraviolet radiation field, under various
assumptions concerning the albedo \( \alpha \) of the interstellar grains.  (This ul-
traviolet radiation field is of particular interest because of the fact that
ultraviolet radiation is capable of profoundly affecting the chemistry of
the interstellar medium.)  By comparing my models with the observations,
I am able to conclude that the albedo of the interstellar grains in the far
ultraviolet is very low, perhaps \( \alpha = 0.1 \).  I also advance arguments that
my present determination of this albedo is much more reliable than any of
the many previous (and conflicting) ultraviolet interstellar grain albedo
determinations.  Beyond this, I show that the ultraviolet background rad-
iation that is observed at high galactic latitudes must be extragalactic in
origin, as the present work demonstrates that it cannot be the backscatter
of the interstellar radiation field.

My new result is that the albedo of the Interstellar Grains in the far
ultraviolet is much lower than is widely believed:
\[ \alpha = 0.4 \text{ at } 1500 \AA \text{ and } \alpha = 0.1 \text{ at still shorter wavelengths.} \]

I got my result by integrating the Hipparcos Input Catalog, and
Kurucz models.  I compared the resulting predicted radiation field
with observations of the radiation field from Apollo 17.  This plot
shows that the catalog goes deep enough to converge: plots are for
\( V = 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0 \) (red), 9.0, 10.0, plus "entire catalog."

The filled black circles are the Apollo 17 observations.  They lie
twice as nicely on the radiation field model with \( \text{albedo} = 0.0 \).  There is a
rise in albedo, to \( \alpha = 0.4 \) (red curve) at \(-1600 \AA \).  (The blue curve
represents an albedo of 0.8).  Ask me about the RED DATA POINT!

The predicted interstellar radiation field, for various
assumed albedos of the interstellar grains (taken to be
independent of wavelength): top curve: \( \text{albedo} = 1.0 \) (all the
extincted light is returned to the beam), next curve: \( \text{albedo} = 0.9 \),
and so on, in steps of 0.1 in the albedo, to the bottom curve
\( \text{albedo} = 0.0 \) (the extincted light is 100% absorbed).

This shows how much backscattered light we should expect at high
galactic latitudes, from a dust layer having \( \text{Av} = 0.1 \), if the albedo
of the interstellar grains is 0.1 (black curve), 0.2 (red curve), 0.3
(blue curve), and isotropic scattering is assumed.  The straight
black lines are cartoons of the actual high galactic latitude
ultraviolet background radiation spectrum.  We conclude that the
observations are \text{NOT} due to the backscattering of the local
interstellar ultraviolet radiation field as evaluated in this paper.

Interstellar extinction, per Cardelli, Clayton, and Mathis 1989.
I find that the grain albedo is \( \alpha = 0.1 \) for wavelengths shorter than
1500 \AA \ (6.7 m\(^{-2}\)), and \( \alpha = 0.4 \) for wavelengths longer than 1500 \AA .
I conclude that it is the smallest grains that have the low albedo.