ON THE POLARIZATION OF THE RESONANTLY SCATTERED Lyα LINES

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The polarization of the resonantly or nearly resonantly scattered Lyα photons by an atomic hydrogen is calculated using the density matrix formalism in the Russell-Saunders approximation scheme. The maximum degree of polarization occurring in a 90° scattering is computed as a function of the frequency shift of the incident photon from the resonance frequency corresponding to a $1S_{1/2}\rightarrow 2P_{1/2}$ transition under the assumption that the scatterers are governed by a Maxwellian distribution.

It is demonstrated that the polarization behavior approaches that of the classical Rayleigh scattering with polarization perpendicular to the scattering plane. It is found that when the frequency deviation of the incident photons in unit of the fine structure level splitting is larger than 4 the maximum degree of polarization is nearly 1.

For smaller frequency shifts the polarization behavior is the weighted average of the two resonance scatterings over the thermal velocity distribution. Around the line center the maximum degree of polarization is 3/11, which is the weighted average of 0 corresponding to the transiton $1S_{1/2}\rightarrow 2P_{1/2}$ and 3/7 for the $1S_{1/2}\rightarrow 2P_{3/2}$ transiton. Depending on the temperature of the medium the degree of polarization deviates from 3/11 in an asymmetric way between the blue part and the red part, which is in high contrast with the symmetric flux profile.

This peculiar behavior may possess an interesting application to the scattering of Lyα photons by high column components, which can be found in active galactic nuclei(AGN). We present a brief discussion in the possible applications including the spectropolarimetry of AGN.

THE EFFECT OF LUMINOUS LENS BLENDING IN GRAVITATIONAL MICROLENSING EXPERIMENTS

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The most important uncertainty in the results of gravitational microlensing experiments comes from the difficulties of photometry caused by the blending of source stars. Recently Nemiroff(1997) pointed out that the results of microlensing experiments can also be affected

by the blending of light from the lens itself if a significant fraction of lenses are composed of stars. In this paper, we estimate the effects of lens blending on the optical depth determination and the derived matter distribution toward the Galactic bulge by using realistic models of the lens matter distribution and a stellar luminosity function. We find that the effect of lens blending is largest for lenses located in the Galactic disk. However, lens blending does not seriously affect both the determination of the optical depth and the Galactic matter distribution. The decrease in optical depth is ~20% even under the extreme assumption that lenses are totally composed of stars and disk matter distribution follows a maximal disk model, in which the lens blending effect is expected to be most severe.

DIFFUSE DARK AND BRIGHT OBJECTS IN THE HUBBLE DEEP FIELD

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We have identified dark and bright objects in the Hubble Deep Field. They are likely to be giant dark clouds and star forming regions at high redshift, respectively. These objects have been found from the difference images between images smoothed with a 0.8'' and 4'' FWHM Gaussian. This procedure eliminates the global flattening error and the local contaminations from brighter stars and galaxies.

From the images at three bandpasses (F450W ,F606W, F814W), we have identified bright peaks with heights between 0.5σ and 3.5σ, and selected the high redshift candidates by color-selection criterion ([F450W-F606W] > 1.2 + [F606W-F814W]). Bright objects typically have AB magnitudes between 29 and 31 in F606W. We have also identified dark cloud candidates with negative peaks in F450W and F606W but a positive peak in F814W.

The reality of bright objects is shown by significant cross-correlation between objects identified at different bandpasses with correlation length of 0.3'', by auto-correlation similar to that of the nearby bright galaxies extrapolated to the sample depth. The auto-correlation of dark objects is weaker than that of bright objects but is still significant.

The bright objects are thought to lie at z > 3.6 with size 1''. They are inferred to be in the process of star-formation and to be the ancestors of the present bright galaxies. From the fact that dark objects have positive peaks in F814W but negatives in F450W and F606W, these objects can be thought to be dark clouds absorbing the background UV light and emitting or transmitting light at longer wavelength. The uncertainties of the image process, such as the effects of hot pixels and the flat field error do not affect out results.