Advance Image Synthesis: Exercises 28.04.2011

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1. Color representation
Calculate the redshift in the wavelength for a light source moving at $10m/s$ emitting yellow light when the camera is at rest. Since the speed of light is much faster than the speed of the light source we can use the slightly simplified formula for the Doppler shift

$$f_{obs} = \left(1 - \frac{v_{rel}}{c}\right) f_{em}$$

where f_{em} and f_{obs} are the emitted and observed frequencies, respectively.

2. Radiometry
a.) Does radiance increase when it passes through a lens?[1]
b.) Compute the irradiance at a point due to a unit-radius disk h meters directly above its normal with constant outgoing radiance of 10 Joule.[2]
c.) Compute the irradiance at a point due to a square quadrilateral with outgoing radiance of $10J$ that has sides of length 1 and is 1 meter directly above the point in the direction of its surface normal.[3]

References

Pharr, M. and G. Humphreys. *Physically Based Rendering: From Theory to Implementation*. second ed. San Francisco, CA, USA: Morgan Kaufmann Publishers Inc., 2010.

[1] This question was inspired by Pat Hanrahan.
[2] Pharr and Humphreys, *Physically Based Rendering: From Theory to Implementation*, Exercise 5.2.
[3] Ibid., Exercise 5.3.