Astronomical Telescopes and Instruments 2017: Exercises on Imagers and Detectors (Due on 15 November 2017 at 13:30)

C.U.Keller

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1 Atmospheric Dispersion Corrector

The Earth's atmosphere refracts light differently for different angles (atmospheric dispersion). The dispersion can be corrected with an Atmospheric Dispersion Corrector.

- 1. Calculate the angular difference of apparent position of a star at 400 nm and at 800 nm for a zenith distance of 60 degrees. Hint: the equations can be found at home.strw.leidenuniv.nl/~keller/Teaching/AOT_2014/AOT_2014_L02_EarthAtmosphere.pdf
- 2. What would be the required wedge angle of a BK7 prism in a telescope pupil to correct this atmospheric dispersion?
- 3. The single-prism corrector will deviate the beam. Design a two-prism system made of BK7 and F2 that will correct the atmospheric dispersion without deviating the beam.

2 Silicon AR Coating

The surface of a backside-illuminated CCD needs to be coated with an anti-reflective thin-film coating to reduce losses due to reflection at the surface.

- 1. Calculate the reflectivity of pure silicon at 580 nm assuming an index of refraction of 4.0.
- 2. What would be the optimum index and physical thickness for a single-layer anti-reflective thin-film coating? What material comes closest to this index of refraction?
- 3. Use your previously developed thin-film code and design an AR coating with minimum reflectivity at 580 nm using two thin-film materials with indices 2.5 and 1.6. What is the order and the thicknesses of the two thin films and what is the remaining reflectivity? Hint: you will need to try different combinations to find a good solution.