Rainbows

October 24, 2022

A *matplotlib* and *Jupyter* Kata

Create an accurate drawing of the following situation and each step of the derivation. For the whole kata, you are not allowed to do any drawings or calculations by hand. Try to work as interactively with *matplotlib* (and possibly *numpy* or *sympy*) in the notebook as possible.

Consider a (spherical) raindrop hit by a beam of sunlight. Put the origin of the coordinate system at the center of the raindrop. The sun is at an angular altitude α. The beam of light enters the drop at point A with polar angle φ_A, gets refracted according to Snell's law, gets reflected at the inner side of the drop and leaves the raindrop after getting refracted one more time. What is the direction β of the light beam with respect to the horizon when it leaves the raindrop? What is β as a function of α and φ_A? Make a plot of $\beta(\varphi_A)$ for different α's.