Polarization conventions and Poincare sphere mapping

<u>Important notes</u>

→ The waveplate data (Fig. 3i.c) is the raw data and is immutable.

→ The Poincare sphere data is a “reconstruction” on the Poincare sphere. This means that it involves both interpolation onto an evenly space grid over the Poincare sphere, and, most importantly for this note, **it depends on the convention used to calculate the polarization from the waveplate angles.**

→ In the paper, we calculated the polarization state from the waveplate data with the following convention: zero degrees is the slow axis aligned with the z axis, represented z by Jones vector [1,0], waveplates rotate clockwise when viewed with light travelling towards your eyes. **This gives L and R states opposite to the usual convention.** Alternatively, one can think that one is viewing the Poincare sphere from “behind” (i.e. 180 degrees rotated) compared with standard conventions.

→ Because we don't define L and R in the paper, and because both conventions for L and R are found in the literature, This is a point of confusion. The most important thing to note is that when standard conventions are used in all calculations, the experimental reconstruction and the theory agree. On the other hand the qualitative behavior (rotation and counter rotation of the structure on the Poincare sphere) which is the main point of the paper doesn't even depend on the convention.

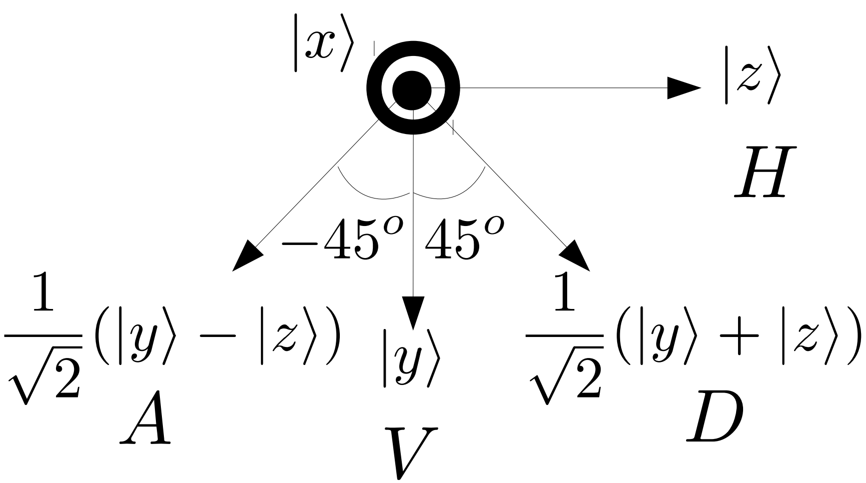
→ Considering the above, the code in this archive calculates the Poincare sphere reconstruction according to the above **non-standard convention**. This means that the theoretical Poincare spheres which use the standard convention must be rotated 180 degrees for comparison

→ The next two pages show the standard definitions for polarization states, and the polarizations which couple to the +z direction of the nanofiber. We plan to use these standard definitions in future work.

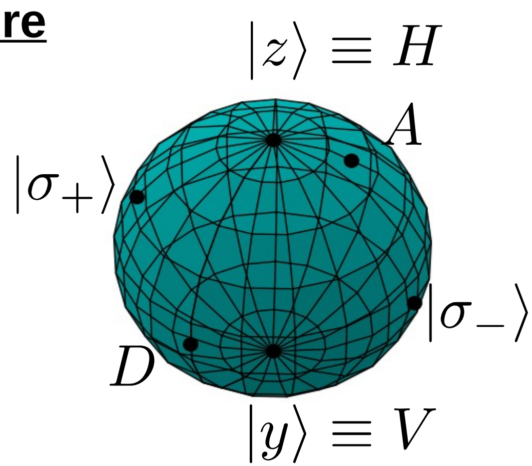
Conventional polarization: Jones Calculus standard convention

Phase convention: $\exp[-\mathrm{i}(\omega t - kx)]$

Linear polarizations



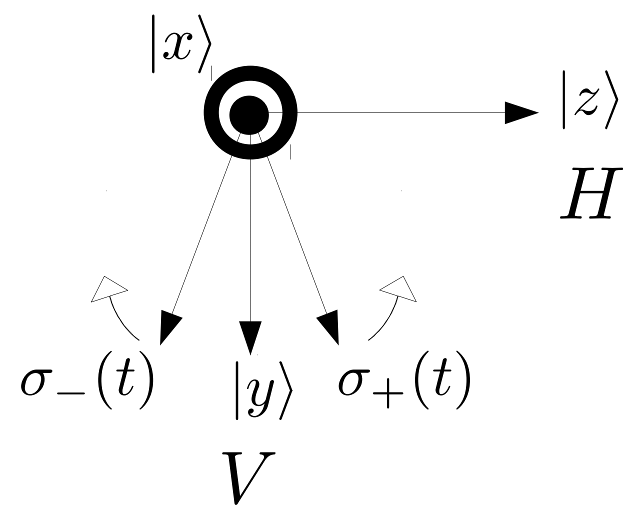
Poincare sphere

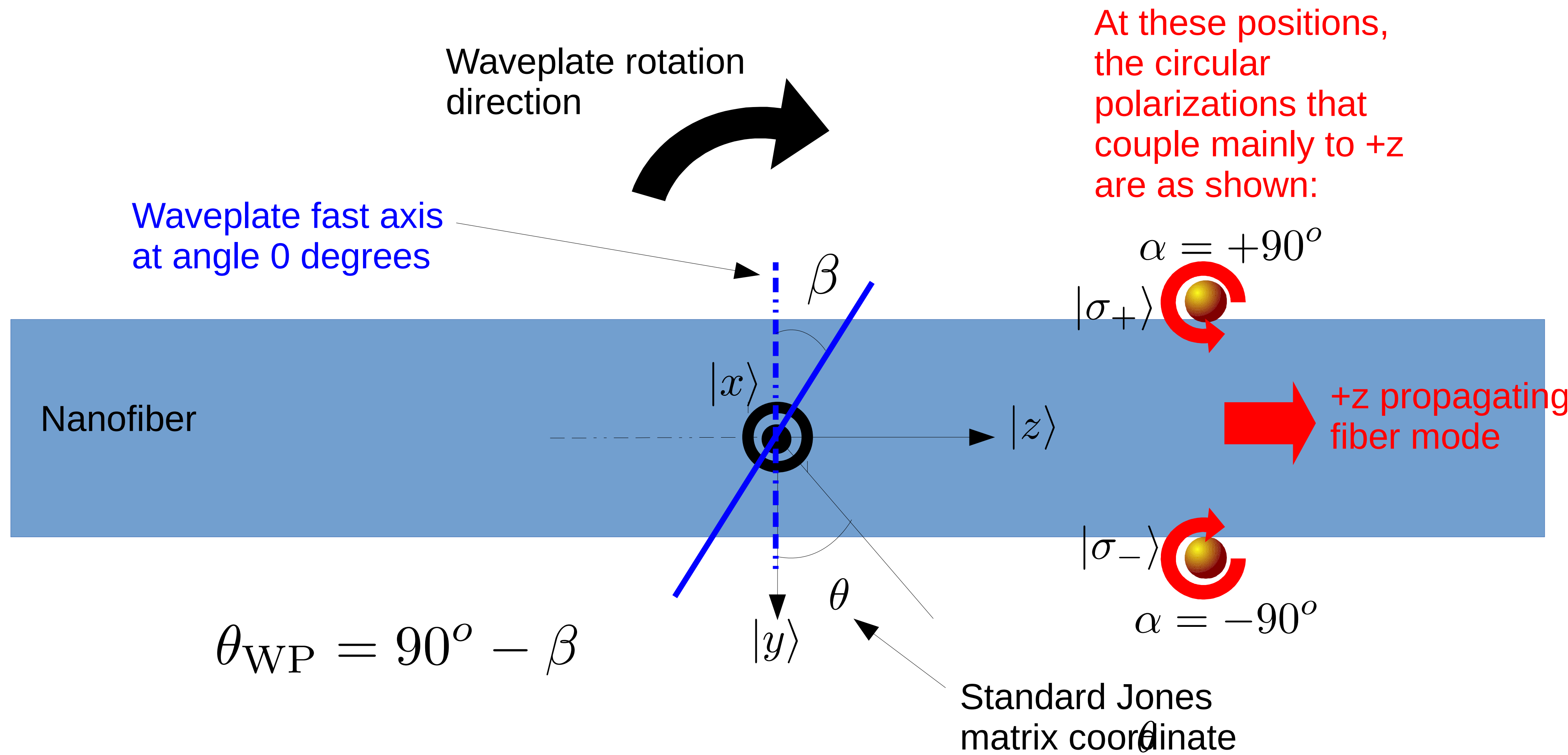


Circular polarizations

$$\sigma_+ = \frac{1}{\sqrt{2}}(|y\rangle + \mathrm{i}|\mathrm{z}\rangle) = \frac{1}{\sqrt{2}}(\mathrm{V} + \mathrm{iH})$$

$$\sigma_- = \frac{1}{\sqrt{2}}(|y\rangle - \mathrm{i}|\mathrm{z}\rangle) = \frac{1}{\sqrt{2}}(\mathrm{V} - \mathrm{iH})$$





Initial polarization state: $|z\rangle \equiv [0, 1]^T$