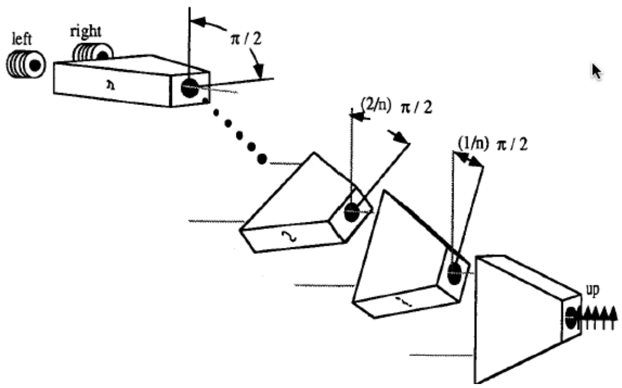
*Photonic Zeno*

1. Imagine a series of $N$ polarization beam sorters like the ones in Fig. 1.2.1 or 1.2.3 are placed so the top x-output beam of each goes into the next sorter in line which is rotated clockwise by an angle $\phi$ relative to the one before. Suppose unit amplitude x-polarization ( $\Psi_x = 1, \Psi_y = 0$ ) comes into the first sorter in the series.

(a) What angle $\phi$ makes the amplitude $1/2^N$ coming out of this series ? (*Zeno attenuation*)

(b) What angle $\phi$ makes the intensity $1/2^N$ coming out of this series ? (*Zeno depletion*)

(c) Suppose the objective is to have as much y-polarization as is practical come out of this series.
How does the output amplitude and intensity vary with the number N?
How many ($N$) sorters are needed to give 99% photon conversion efficiency ?




*Electronic Zeno*

2. Imagine a series of $N$ electron beam sorters like the ones in Fig. 1.1.6 or 1.2.4 are placed so the top ↑- (up) output beam of each goes into the next sorter in line which is rotated clockwise by an angle $\phi$ relative to the one before. Suppose unit amplitude ↑- spin ( $\Psi_\uparrow = 1$ , $\Psi_\downarrow = 0$ ) comes into the first sorter in the series.

(a) What angle $\phi$ makes the amplitude $1/2^N$ coming out of this series ? (*Zeno attenuation*)

(b) What angle $\phi$ makes the intensity $1/2^N$ coming out of this series ? (*Zeno depletion*)

(c) Suppose the objective is to maximize ↓-spin (down) output from this series. How does the output amplitude and intensity vary with the number N?
How many ($N$) sorters are needed to give 99% electron conversion efficiency ?
(This is called *adiabatic reversal*.)

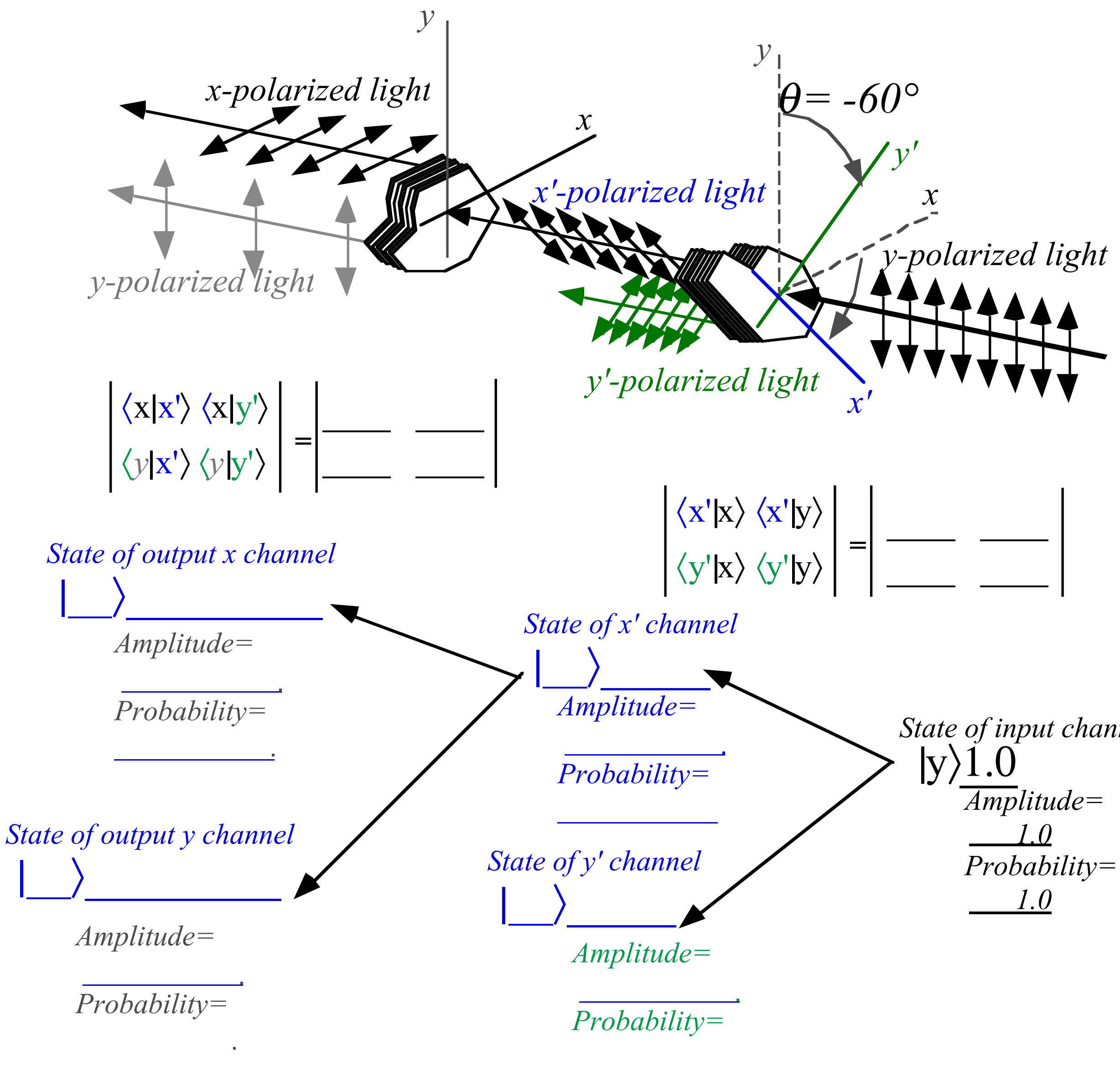
3. Effects of a 1/4-wave and a 1/2-wave plate are described in (1.3.1)- (1.3.3) and Fig. 1.3.6 for an input polarization angle of $\theta=30°$ relative to $x$-axis. Here consider $\theta=45°$.

(a) Describe effect of a "whole-wave" plate. ($\Omega$=____? Give $\Psi$ and sketch Re$\Psi_x$ vs. Re$\Psi_y$ path.)

(b) Describe effect of a "1/3-wave" plate. ($\Omega$=____? Give $\Psi$ and sketch Re$\Psi_x$ vs. Re$\Psi_y$ path.)

*Polarizer exercise*

1.2.1. A y-polarized light beam of unit amplitude (1 photon/sec.) enters the analyzer system as shown below. Fill in the blanks with numbers or symbols that tell as much as possible about what is present at each channel or branch.




*A Dim View*

1.2.2 (a) How far away from KUAF ($10^5$ Watts at 91.3 MHz) do you only get 1 photon/$m^2$s?

(b) How far away from a $10^5$ Watt green light source do you only get 1 photon/$m^2$s? Assume (incorrectly) scalar isotropic coherent wave sources.

Give *mks* E-field amplitude in each case.