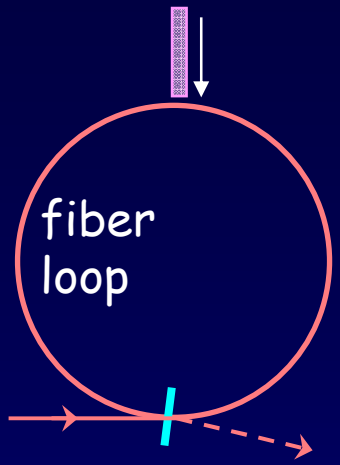
FYI: Modern Applications in Navigation

Consider the following "Sagnac" ["sahn-yack"] interferometer. Here the two possible paths are the clockwise and counter-clockwise circuits around the fiber loop.



1. If we insert an extra piece of glass as shown, how does the relative path length change?

It doesn't! Because the interference paths completely overlap, the Sagnac is a remarkably stable interferometer, e.g., to temperature fluctuations in the fiber.

2. How could we change the relative path-length difference, and thereby change how much light exits the bottom port?

Rotate the entire interferometer (in the plane of the paper). For example, if we rotate it clockwise, the light making the clockwise circuit will have farther to go (the beamsplitter is "running away"), while the counterclockwise path will be shortened.

It is not difficult to show that

$$\phi \approx \frac{2\pi}{\lambda}\frac{4\left(\pi R^2\right)\omega}{c^2}$$

Monitor output intensity → determine ϕ → rate of rotation ω → "laser ring gyroscope"!