



App Note: DLS-04

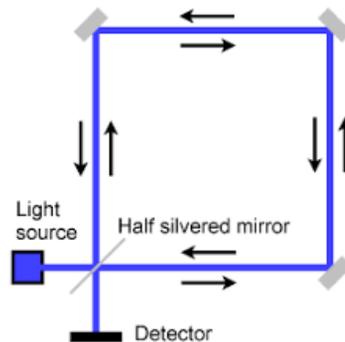
Application Notes Fiber- Optic Gyroscopes

1. Introduction

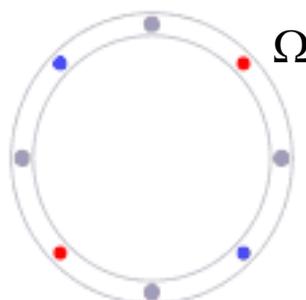
- 1.1 Fiber-Optic Gyroscopes (FOG) are based on Sagnac effect interferometer and compounds the effect multiple times by using multiple coils for the light to travel. The differential phase shift is effectively multiplied by each additional coil for increased sensitivity. FOG are extremely reliable and are well-suited for harsh environments, since it does not contain any moving parts.
- 1.2 There are several established applications of FOG, including Autonomous vehicles, Missile guidance, Marine and Navy gyrocompass, Land & Airborne surveys, Race cars & Motorboards, Oil & Gas drilling equipment, etc.
- 1.3 DenseLight's SLED products have been well established in the global FOG markets.

2. Principle of FOG - The Sagnac interferometer

- 2.1 When two beams of light traveling the same path in opposite directions, they will undergo phase changes if the whole apparatus experiences angular velocity Ω .



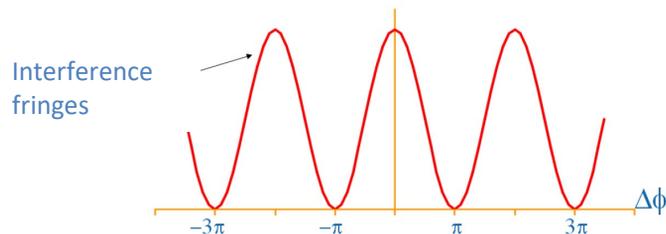
If the apparatus rotates clockwise, the beam moving clockwise effectively travels a slightly longer path than the beam travelling counterclockwise (and vice versa) creating a path difference between the two beams of light. As shown below, the red and blue dots represent counter-propagating photons, the grey dots represent molecules in the loop material.



The light (recombination of the 2 beams) reaching the detector exhibits an interference pattern.

The position of the interference fringes is dependent on the angular velocity Ω of the apparatus.

$$\square \approx \frac{8\pi A}{\lambda} \cdot \Omega$$



3. FOG light source requirements

- 3.1 Main FOG light source requirements: Large bandwidth, High PER, Low RIN, Long term Wavelength stability, Low cost, Low form factor, High reliability, Low power consumption, etc.
- 3.2 DenseLight offers a wide range of broadband SLED modules which come in 8-pin and 14-pin BTF packaging suited for the most demanding FOG systems. In addition, DenseLight also offers Low DOP SLED chips for FOG applications.

Products	Form Factor	Product Code	Specification
SLED	14-pin BTF	DL -CS5103A DL -CS5153A DL -CS5203A	Typ. WL 1550 nm Typ. FWHM 40 nm Min. Power 10, 15, 20, 35 mW SMF/PMF
	14-pin BTF	DL -CS3159A	Typ. WL 1310 nm Typ. FWHM 83 nm Min. Power 15 mW
	8-pin BTF	DL-CS50L4C DL-CS55057C	Typ WL 1550 nm Typ FWHM 40, 60 nm Min Power 1, 5 mW
Low DOP SLED	COS	TBD 1310nm 1550nm	2mW output with DOP of 1dB; Bandwidth of 35nm; Optimized epi and device structure for high SLED output with low DOP