

# Laser in LIDAR Applications

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# Laser in LIDAR

**Light Detection and Ranging (LIDAR)-** This is a method used to determine ranges by shining a laser beam on an object and measuring the time taken for the beam to be reflected back to the receiver.

## **Types of LIDAR:**

1. Topographic Lidar- Uses a near-infrared laser to map the land.
2. Bathymetric Lidar- Uses water-penetrating green light to also measure sea-floor and riverbed elevations.

## **Types of Laser used in LIDAR:**

According to type of Active Medium:

1. **Solid-State Laser.**
2. **Fiber Laser.**

According to Mode of Operation:

1. **Pulsed mode using Q-switched emission**

# TOPOGRAPHIC LIDAR (Focus)

The focus is on Topographic LIDAR, used for earth mapping. Normally mounted on aerial vehicles.

The specific laser beam used is described below with reasons why they are used.

Technology	Wavelength	Classification		Why used
		<i>Active Medium</i>	<i>Mode of operation</i>	
Erbium Fiber Laser	1550 nm	Fiber	Pulsed (Q-switched Emission and Quasi Continuous Pumping - [QCW] of Nd:YAG Crystals	<ul style="list-style-type: none"><li>• Range of &gt; 100m</li><li>• Resolution</li><li>• Safety [Should be safe for people]</li><li>• Enough energy to withstand 'background noise'</li></ul>

# Parameters

## Parameters of various lasers used in Topographic LIDAR:

Technology	Wave length	Energy	Frequency	Pulse Duration
Pulsed Laser Diode	905 nm	< 10 $\mu$ J	0-10kHz	30-200ns
Erbium Fiber Laser	1550 nm	< 400 $\mu$ J	10skHz	5-100ns
Yb Fiber Laser	1064 nm	< 200 $\mu$ J	10skHz	5-100ns
DPSS Nd: YAG	1064 nm	< 60mJ	< 100Hz	5-10ns

# References

1. Chazette, P., Hespel, L., Totems, J., & Bailly, J.-S. (2016, December). *Principle and Physics of the LiDAR Measurement*. Research Gate. Retrieved May 19, 2022, from [https://www.researchgate.net/publication/308941555\\_Principle\\_and\\_Physics\\_of\\_the\\_LiDAR\\_Measurement](https://www.researchgate.net/publication/308941555_Principle_and_Physics_of_the_LiDAR_Measurement)
1. US Department of Commerce, N. O. and A. A. (2012, October 1). *What is Lidar*. NOAA's National Ocean Service. Retrieved May 19, 2022, from <https://oceanservice.noaa.gov/facts/lidar.html#:~:text=Two%20types%20of%20lidar%20are,measure%20seafloor%20and%20riverbed%20elevations.>