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TECHNICAL SEMINAR

# **FREE SPACE LASER COMMUNICATION**

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# AGENDA

- Introduction
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- Working
- Working Principle
- Advantages
- Applications
- Conclusion

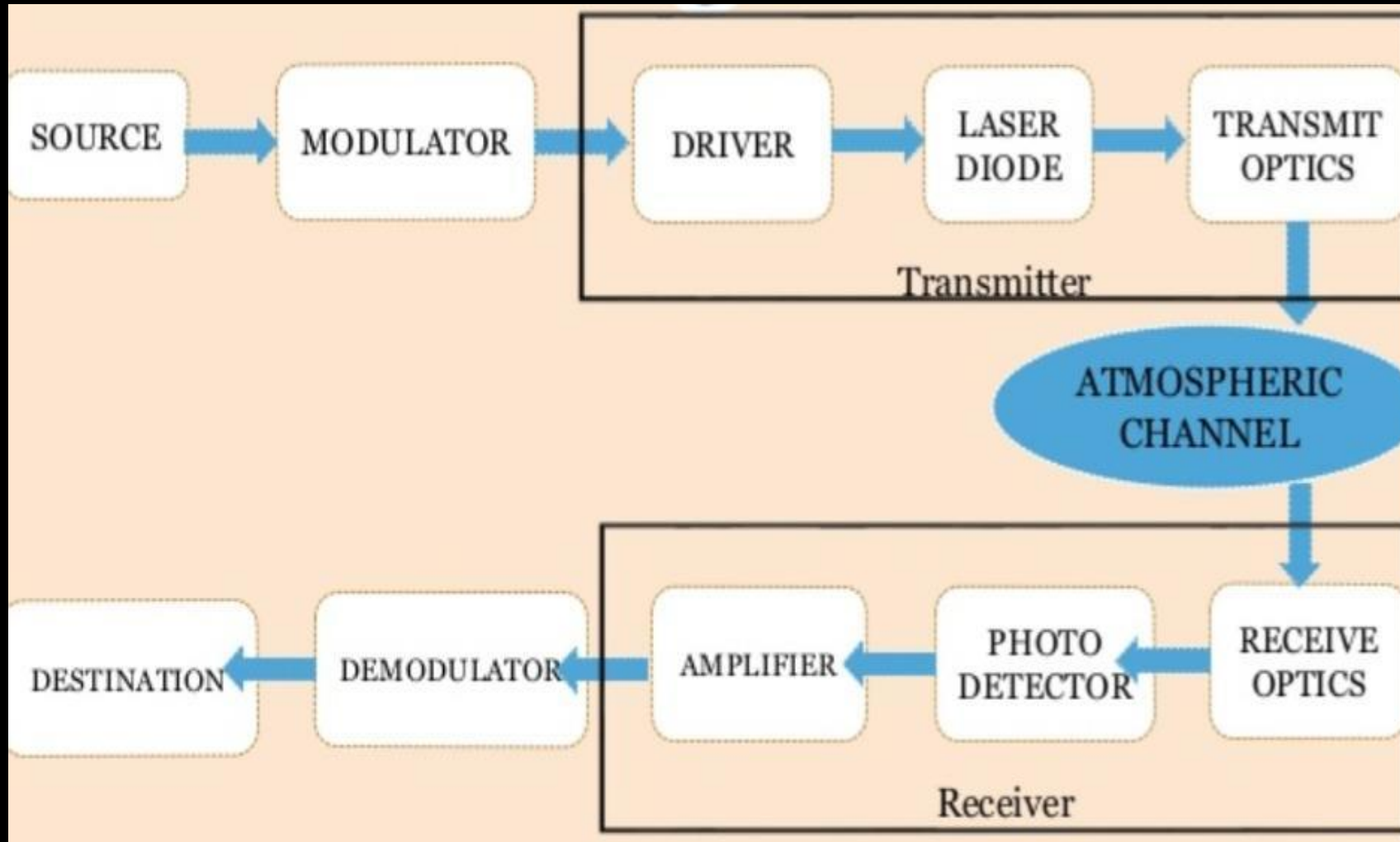


# INTRODUCTION

A satellite with large solar panels is shown in space, emitting several bright blue laser beams. One beam points towards another satellite in the distance, while others point towards the Earth's surface. The background is a deep blue space filled with stars, and the Earth's horizon is visible with a thin layer of atmosphere.

- Laser communication systems are wireless connections through the atmosphere for broadband communications.
- Uses laser beams to transmit information between two locations.
- Since it is a wireless technology, no fibres needed.
- It is an upcoming technology used for broadband communication as we face Radio Frequency spectrum scarcity with respect to increasing throughput requirements.
- Delivers cost effective wireless connectivity, power efficient, and a faster return of investment for enterprises and mobile carriers.
- Of high usage where physical connections are impractical due to high costs and other considerations.

# BLOCK DIAGRAM





- **Source**

Can be audio, video, or any type of document.

- **Modulator**

It increases the strength of signal.

- **Driver**

Acts as an interface between source and circuit. It is the constant source of current.

- **Laser Diode**

Semiconductor of PN junction which emits coherent light in which all waves are at same frequency and phase.

- **Transmit optics**

Laser lenses are designed to focus homogenize or shape laser beam.

- **Receiver optics**

Converts optical signal into electrical signal.

- **Photo detector**

It detects the incident light.

- **Demodulator**

Use to separate the original signal from the modulated signal.

# WORKING

- 2 TRANSMITTER (LASER) PROJECTS THE CAREFULLY AIMED LIGHT PULSES INTO FREE SPACE



- 3 A RECEIVER (PHOTO DETECTOR) AT THE OTHER END OF THE LINK COLLECTS THE LIGHT USING LENSES AND/OR MIRRORS



- 5 REVERSE DIRECTION DATA TRANSPORTED THE SAME WAY, ENABLING FULL-DUPLEX COMMUNICATION

- 1 NETWORK TRAFFIC CONVERTED INTO PULSES OF INVISIBLE LIGHT

- 4 RECEIVED SIGNAL CONVERTED BACK INTO OPTICAL OR ELECTRICAL AND CONNECTED TO THE BUILDING NETWORK

# WORKING PRINCIPLE

- **ABSORPTION**
- **SPONTANEOUS EMISSION**
- **SIMULATED EMISSION**
- **POPULATION INVERSION**



# ADVANTAGES

- Free space optics is a flexible network that delivers better speed than broadband.
- Installation is very easy and it takes less than 30 minutes to install at normal locations.
- It has very low initial investment.
- It is a straight forward deployment system. There is no need for spectrum license or frequency coordination between users as it is required in radio and microwave systems previously.
- It is a secure system because of line of sight operation and so no security system upgradation is needed.
- High data rate can be obtained which is comparable to the optical fiber cable's data rate but error rate is very low and the extremely narrow laser beam enables having unlimited number of FSO links which can be installed in a specific area.
- There is immunity to radio frequency interference. Electromagnetic and radio-magnetic interference cannot affect the transmission in FSLC link.

- FSLC offers dense spatial bandwidth.
- Low power usage per transmitted bit is merit of FSO system.
- Transmission of optical beam is done in air. Hence, transmission is having speed of light.

# APPLICATIONS

- **Outdoor wireless access:**

It can be used by wireless service providers for communication and it requires no license to use the FSO as it is required in case of microwave bands.

- **Storage Area Network (SAN):**

FSO links can be used to form a SAN. It is a network which is known to provide access to consolidated, block level data storage.

- **Last-mile access:**

To lay cables for users in the last mile is very costly for service providers as the cost of digging to lay fiber is very high. FSLC can be used to solve such problem by implementing it in the last mile along with other networks. It is a high speed link.

- **Metro-network extensions:**

It can be used in extending the fiber rings of an existing metropolitan area. FSLC system can be deployed in lesser time and connection of the new networks and core infrastructure is easily done. It can also be used to complete SONET rings.



- **Fiber backup:**

FSLC can also be applicable in providing a backup link in case of failure of transmission through fiber link.

- **Backhaul:**

It can be helpful in carrying the traffic of cellular telephone from antenna towers back to the PSTN with high speed and high data rate. The speed of transmission would increase.

- **Bridging WAN Access:**

FSLC is beneficial in WAN where it supports high speed data services for mobile users and small satellite terminals. It can be used to communicate between point-to-point links, for example, two buildings, two ships, and point-to-multipoint links, for example, from aircraft to ground or satellite to ground, for short and long reach communication.

- **Military access:**

As it is a secure and undetectable system it can connect large areas safely with minimal planning and deployment time and is hence suitable for military applications.

# CONCLUSION

For future short-range applications, laser wireless communications present a viable and promising supplemental technology to radio wireless systems and optical fiber.

It provides a low cost, rapidly deployable method of gaining access to connections and provides the lowest cost transmission capacity in the broadband industry saving substantial up-front capital investments.

Can be installed for as little as one-tenth of the cost of laying fiber cable, and about half as much as comparable microwave/Radio Frequency wireless systems thus eliminating the need to buy expensive spectrum, which further distinguishes it from fixed wireless technologies.

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**THANK  
YOU**

