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ENGINEERING PHYSICS

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ENGINEERING PHYSICS

Unit IV : Application of Quantum Mechanics to Optical Waves: LASERS

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Class #41

- Helium-Neon laser
- Gas laser
- Atomic laser
- Construction
- Energy level diagram

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Helium Neon laser

- ***Suggested Reading***
- ***Optical Electronics ,A. Yariv***

2. Course material developed by the Department

- ***Reference Videos***

https://ocw.mit.edu/resources/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/laser-fundamentals-i/

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He-Ne laser

- First gas laser
- Atomic excitations of electrons in the atoms of Ne
- 632.8 nm laser (visible)
- Continuous Four level laser
- High quality beam
- Power ~ a few mW

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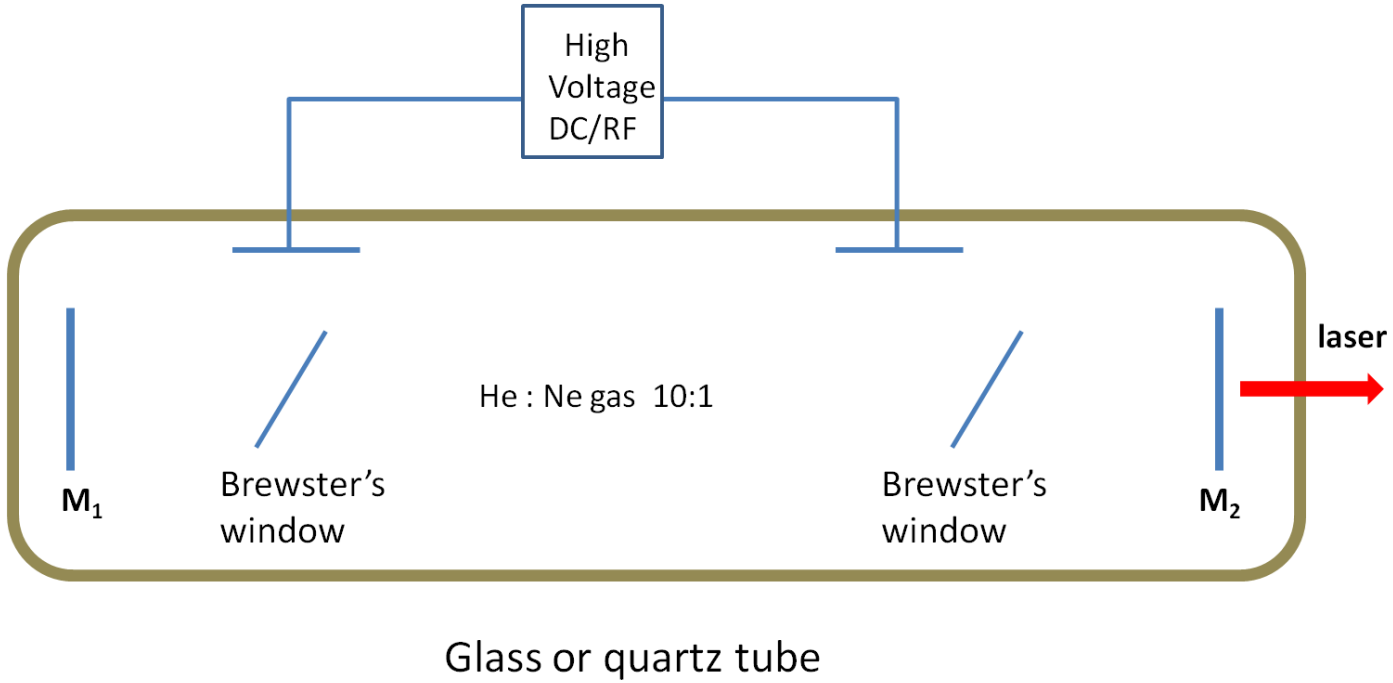
He-Ne laser: Construction



- Evacuated glass/quartz tube (long and narrow)
- Gas mixture of typically 1 mmHg of He and 0.1 mmHg of Ne.
- A DC or RF supply for electron discharge through the gas mixture

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He-Ne laser

- **Energetic electrons in the discharge excite electrons in the helium atoms to 2_3S and 2_1S states which are meta-stable.**

$$e^* + He \Rightarrow e + He^*$$

*where * indicates high energy or excited state*

- **When these helium atoms collide with the neon atoms they excite electrons of neon atoms into2S and 3S states (which nearly coincide with the 2_3S and 2_1S of He).**

$$He^* + Ne \Rightarrow He + Ne^*$$

*where * indicates high energy or excited state*

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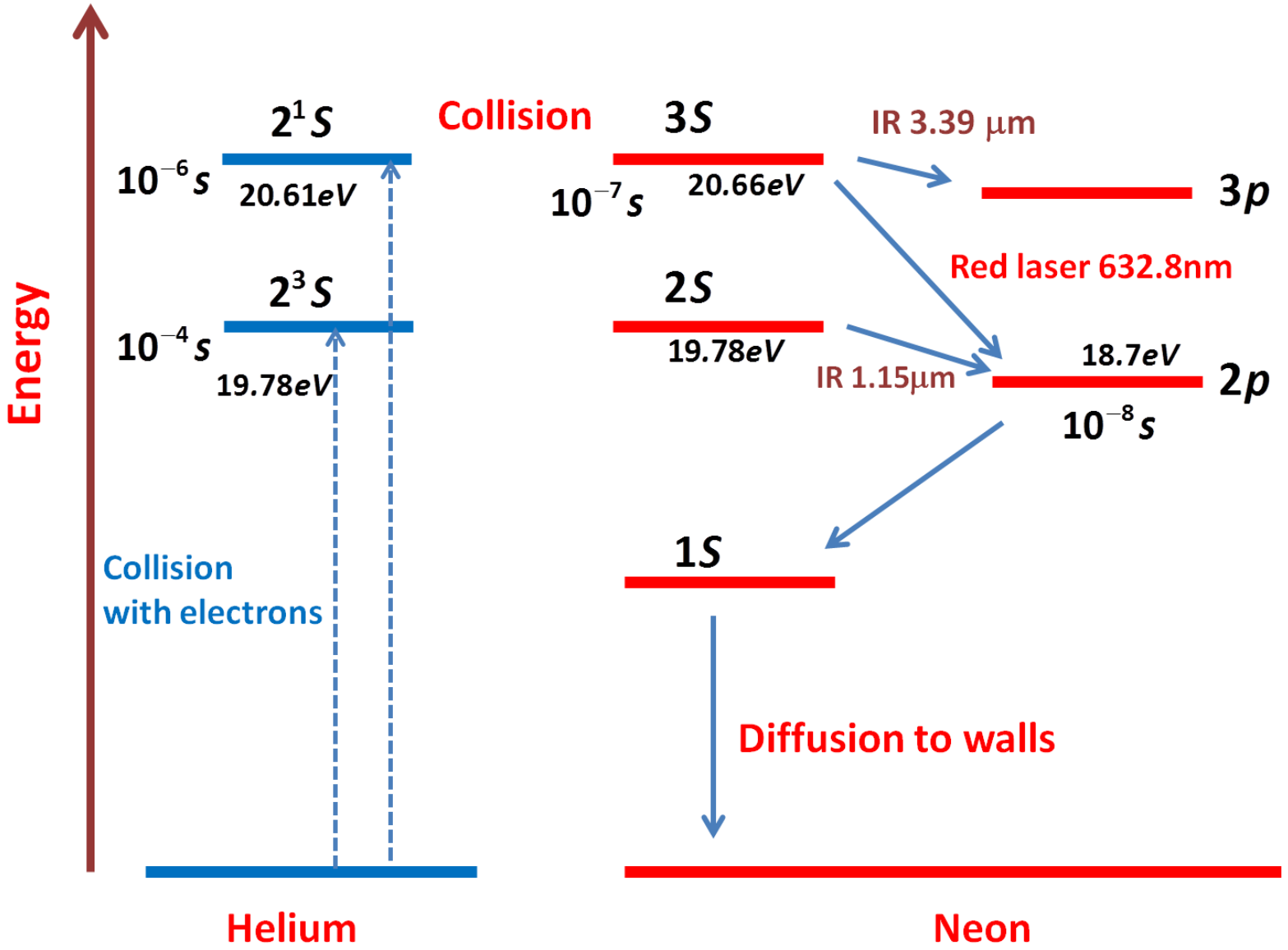
He Ne laser Energy level diagram



$3S \rightarrow 2P$

Transition gives the Red laser

He-Ne laser

Check Your Understanding (Yes/No)

1. ***Helium Neon laser is a molecular laser***

2. ***IR emission in the Neon system is strong***

3. ***1S of neon levels is a meta stable state***

4. ***Flash lamp is used for achieving population inversion***

THANK YOU

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