

RESEARCH ARTICLE

Contemplation of the Photonics Beam to Complement the Water Cycle in Gulf Region

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HIGHLIGHTS

- The significant of the based on the fresh look to utilise the laser beam.
- The capabilities of the laser provies a potential to solve the environmental issue.
- The main contribution is a novel study that open the door for the companies to to think through unprecedented technical wise.
- To evaluate the potential of suitable wavelengths that deal with the absorption in the atmosphere. study and obtained results why is important.

Keywords:

- Elevated duct
- Refractive profiles
- Propagation facto
- Fading
- Loss

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GRAPHICAL ABSTRACT

The unparalleled laser beam provides promising avenues of future research and continuation solutions concerning due to its unimaginable capabilities. One of the great advantages that could be achieved is complemented the water cycle particularly when gaseous factories waste concentrate in the manufacturing countries atmosphere where the high contamination reach to works as a layer in front of the normal water life cycle, thus the perforation process become indispensable using a specific instrument such as the laser beam.

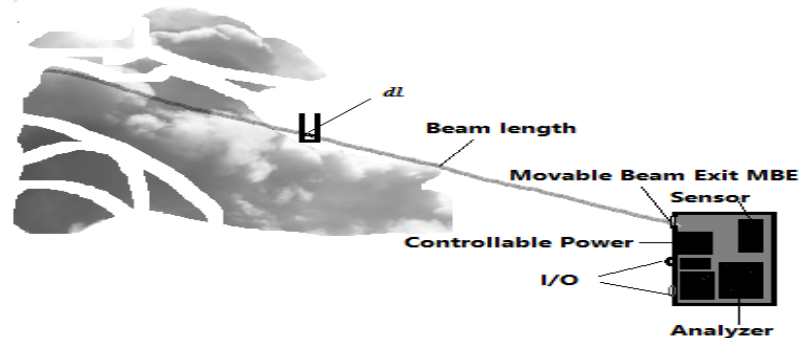


Figure 1. Optical beam station model to complement the water life cycle

Aim of Article: Enhance the water cycle in the Gulf region and mitigate impact rain outage through providing a technical applicable solution.

Theory and Methodology: The optical beam terminal put forward to shoot the loaded beam at a specific area to pass through the accumulation of pollution layers in the air. The beam initially controlled via parameters such as the power to produce a suitable heat among the layers, and the sensor to sense the layer contents, thus select a proper wavelength to avoid attenuation due to absorption and scattering.

Findings and Results: optical beam station proposed and discussed the capability to control, sense, and analyze in keeping with the atmospheric weather circumstance, the wavelength absorption gives the partial stability between 610 nm to 700 nm indicated that easy to see less disturbance in a visible wave then start to rise after that up to reach the peak at 1100 nm to 1150 nm.

Conclusion: The proposal gives a fresh look to the laser beam to provide a solution that could contribute to complete the water cycle through laser carrier carry the evaporation gases via pollution layer to reach the condensation layer and complete the process. The result showed the lowest wavelength prone to absorption between 610 nm up to 700 nm and from 1550 nm until 1600 nm. While the highest severely to the phenomenon around 1100 nm up to 1150 nm.



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ABSTRACT

Photonic beam has attracted massive researchers' attention from the time of invention in the earlier decades and would continue due to unimaginable characteristics that contributed potentially to reach the highest data transmission rate and remarkable bandwidth in addition to the less susceptible to the environmental parameters via hundreds of kilometers. This advantage gives to think about it to address the water cycle issue in the shortage water region such as Gulf countries. The proposal considers the controllable beam properties that could carry the evaporation gas to pass through the air pollution layers and complete the condensation process hence reinforces an increase in rainfall chances, and lead to reducing the desalination process as well cost-effectiveness. Accordingly, the photonics beam station could sense and analyze the pollution layer to make a proper decision based on the data variability. The paper takes into account the matter via suggesting a new model that accommodates the significant environmental parameters in the desert area particularly in Qatar which is severely prone to the water lake due to salinity and stark weather in addition to the oil and gas manufacturing, which add a heavy layer in the atmosphere. So, this proofing would help the government sector strikingly the meteorology, energy, and resources to mitigate the impact of water shortage and provide a technical solution that would reflect in the whole countries economy. The work also attention to the absorption phenomenon for the most significant available wavelengths such as 850,1330 and 1550 nm and the results demonstrated the lowest wavelength prone to absorption between 610 nm up to 700 nm and from 1550 nm until 1600 nm.

Keywords: Elevated duct , refractive profiles, propagation factor, fading , loss

I. INTRODUCTION

In the recent decade, revolution growth has been noticed in the advanced communication technologies due to increasing usage of cloud, live streaming, and video conferencing as a whole represents a part of the

high-speed internet service. The customer demands need endless capacity and massive bandwidth to fulfill modern life needs. The limitation of the Radio Frequency RF carrier in addition to exceedingly challenges even when thinking about a rising to higher



frequencies such as millimeter-wave [1,2], which could provide a vast bandwidth but with susceptible to the climate atmospheric, hence to accommodate that, they give a line of thinking to shift to the optical carrier instead of Rf. However, the optical carrier has various advantages such as spectrum restriction and licensing in addition to high capacity and inconceivable bandwidth to carry the data, even the power consumption is quite better than the RF [3]. For these features and more, the narrow directivity beam promising to do lots in the upcoming digitalization and beyond. Our study based on the Photonic Beam PhB which is distinguished from others by the beam coherent passing long distances. Thus, this characteristic gives the edge to play a prime service to solve various challenges in many sectors such as natural resource particularly in the countries located in the desert area and suffering from the water shortage [4]. The industrial countries consider the water resources availability as part of national security, while the scarcity of natural water could push the governments to consume a huge financial to provide it. This work proposed laser photonics to accommodate the shortage of water as anticipated in the Gulf countries and particularly in Qatar which is a small peninsula located in the Arabian Gulf one of the highest seawater salinity globally [5] surrounded by water from three directions with stark desert climate led to totally depends on the desalination process when considering the water availability, considered a horrible situation to the government financially and environmentally. In addition to that, oil and gas manufacturing is taking into account the main contributor to air pollution and presents a negative impact on utterly environmentally as well as healthy [2,6]. This various pollution could increase the atmospheric layers and lead to blocking the water evaporation and hence outage in the water life cycle. The rare rain in the country becomes inconvenient for the farmers, birds, and a whole wildlife. This situation gives a unique opportunity to open a new chapter to use the proposal to accommodate the issue and provide a solution without compromise an environment.

Different examinations based on the optical link have been proposed to equalize the environmental challenges, for instance in [7] the authors measure atmospheric turbulence using a relay mirror for the three different laser beam that radiator for 350 km from the ground to the satellite, whereas in [8] the laser transmitter station from California and New Mexico

demonstrated distortion of the laser beam via atmospheric due to turbulence. Also, the comparison between theoretical and experimental has been achieved utilizing argon-ion laser [9] and the result has shown lognormal distribution in the received signal, whereas the adaptive optics was used to decrease the atmospheric turbulence through correct the leaving beam in single pulse that contains more than 100 photons [10]. Continuously to review direction, the laser has been used for the military purpose to provide data up to 30 Mbps using 5 W at 1064 nm between Earth and Mars [11].

These literature reviews open the door to focus on the laser beam capability to enhance the water cycle in the Gulf region and mitigate impact rain outage, in addition, to give thought to the desert climate fluctuation and providing a technical applicable solution. Furthermore, the various gas accumulation and highest salinity seawater with the elevated humidity due to rising temperatures provide a unique distinguishing aspect. The rest of the paper is organized as follows; in the following section, the optical beam characteristics in water cycle to describe the proposal thoughts. While the section 3 demonstrates the model approach; and in section 4 the analysis and discussion to obtain outcomes, then finally, summarize the work with recommendation for future work.

II. PHOTONIC BEAM PROPERTIES

The proposal of laser beam to implement the evaporation process and complete the significant missing stage in the water cycle based on the beam properties and environmental parameters for the specific area. Accordingly, the study focuses on the Arabian Gulf area; particularly in Qatar state which is considered one of the fastest-growing countries globally with the most significant oil and gas industry. Although it which located in a peninsula surrounded by water from three directions the woefully insufficient annual rainfall consider notable yearly [4]. In addition to that, the highest seawater salinity universally gives dramatically different environment. Further, the desert weather among the salt seawater there is fully qualified to achieve the task through the unique phenomenon. Whereas air pollution eliminates the water cycle process due to accumulation layers. The high-temperature whether by heat or electricity stimulating the atom to generate a charge and emerges the light, while the laser generates same the light through stimulating photonics of certain gases such as neon,



argon, and helium. Despite the laser beam is quite dangerous as it could be loaded to carry a massive amount of energy and become harmful, while the useful applications are undeniable starting from the highly accurate measurements, alloys, welding, and cutting iron until medicine and operations without bleeding. Whereas the famous revolution laser used lay in fiber optics telecommunication field. The high bandwidth, focusing, unlicensed spectrum, and far up security gives the laser beam utterly and unmistakably advantages from others. For instance, the sharp directivity laser beam in 10 kW is quite enough to cut a heavy glass plate [12,13] from laser beam consequences point of view. When the controllable beam heat interacts with the weather factors such as fog, it will give a positive action through a strike and passes the photonics heat hence make a duct depends on the beam directivity bandwidth [14]. The unparalleled beam properties could comfortably hit where the target is, and reaching out loaded by the various energy, data, and gases. The evaporation process needs an open water surface with a high temperature to change the state of the matter from the liquid to the gas [15]. Whereas to complement the water cycle, the beam should carry this gas and pass into the condensation layer in the cloud, that is based on the thickness of the gasses layers in the air which are work as the blocker. The next section will denote the manageable optical beam terminal invention which is contributing to the research in different areas such as meteorological, manufacturing, and ecology.

III. THE MODEL APPROACH

For a comprehensive understanding, the optical beam terminal put forward to shoot the loaded beam at a specific area to pass through the accumulation of pollution layers in the air. The beam initially controlled via parameters such as the power to produce a suitable heat among the layers, and the sensor to senses the layer contents, thus select a proper wavelength to avoid attenuation due to absorption and scattering [16]. The Beam specification B in frequency f_p loaded by energy to pass the pollution layer in the air vd , hence from the Doppler effect law [17]:

$$B = f_p \left(\frac{vp + vd}{vp} \right) \left(\frac{vp}{vp - vd} \right) \cdot j \quad (1)$$

and after calculations equation 2 has been obtained below:

$$B = f_p \left(\frac{vp + vd}{vp - vd} \right) \cdot j \quad (2)$$

where f_p is photon frequency, vp photon velocity in the beam, vd layer movement via the air, and j is model

factor which is equal to $n\varphi$ where n represents the refractive index when the beam transfers between different weather mediums and equal to the ratio between the speed of light in vacuum to the speed of light in medium and give clear result that higher reflective index of the medium at the nominator leads to light travel more slower in the medium, and φ is an atmospheric coefficient depends on the various weather parameters [18].

Due to distinguish weather aspects in the Gulf region, j should consider as the key role to accurate the model. The stark humidity and unimaginably temperature mixed with factories cement, oil, and gas in the global dust belt, can form a tremendous air layer blockage leads to prohibitive the evaporation gas pass to higher. If consider the pollution layer at the θ , and the probability to pass through it σ equal to:

$$\sigma = \theta n\varphi \quad (3)$$

$$n\varphi = \sigma / \theta \quad (4)$$

where σ is the chance to push through, θ air pollution thickness layer, and $n\varphi$ equal to j which is the model factor. Hence, the equation could be valid for the turbulence weather with consider:

$$B = \frac{\sigma f_p}{\theta} \left(\frac{vp + vd}{vp - vd} \right) \quad (5)$$

while from the Column law which describe the charge q along the beam length l [19].

$$\lambda = q / l \quad (6)$$

where λ is a linear density that will help to calculate to the small beam photon

$$dq = \lambda dl \quad (7)$$

The electricity filed E that could strike the layer θ from the charge (photon) dq can calculate is:

$$dE = n\varphi dq / l^2 \quad (8)$$

Hence

$$= n\varphi \lambda dl / l^2 \quad (9)$$

$$= \int n\varphi \lambda dl / l^2$$

$$= n\varphi \lambda \int l^{-1} dl$$

$$= n\varphi \lambda / l$$

where $n\varphi$ (j) is the constant model factor and represents the refractive index in atmospheric weather, dq is one charge (photon) pick up from the laser beam and the l

is the length of the beam. While in agreement with the charge and electricity field could calculate the force F based on the Newton law [20].

To express in a certain manner, the next figure 1 denotes the mini directional optical beam terminal when hit an accumulation layer in the atmosphere.

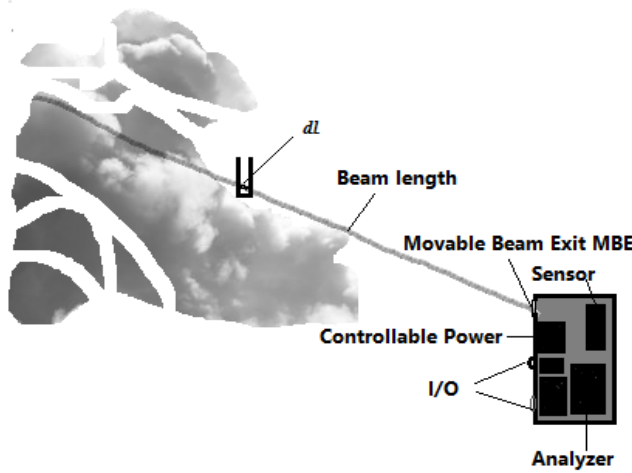


Figure 1. Optical beam station proposed for water life cycle

From equation 5 prospective, the momentum inversely proportional with the wavelength which leads to increasing the energy that increase the frequency and decreasing the wavelength, thus raise the loaded photonics energy as well as ability to pass a cross the air pollution layers, while in equation 9 the relation between electricity field E and the beam length l demonstrates also the inversely correlation when hit the layer in the atmosphere.

As reported in the beam terminal parts which is consist of the:

- a- Analyzer:
It works like a microcontroller in the electronic devices through makes an order such as increase or decrease the power after analysis the operations.
- b- Sensor:
To sense the gases and other air pollution accumulation in the air layers and provides the feedback to take the decision which it could be contents of Light Detection and Ranging (LiDAR) to capable the vision from the air environment.
- c- Movable Beam Exit:
Through controllable movement, the beam carries the evaporation gases and hit the air

layer via appropriate carrier. It might be directional and concentrated on the specific point to achieve the target based on the wavelength and the aperture diameter.

- d- Controllable Power:
Supplies the power depends on the layer formation in the air; as well as through it could be mitigating the noise via provide an appropriate narrow beam power.
- e- I/O:
To transfer the data when make connection with the other peripheral devices.

Concerning the atmospheric parameter, the figure 2 shows the significant beam wavelength characteristic from the absorption prospective [10], which is assist the photonics engineers to select the proper wavelength and get the flawless system, while table 1 below demonstrated the calculation correlation of the absorption phenomenon for given wavelengths.

Table 1: Relation between wavelength and Absorption

Wavelength in nm	Absorption dB/Km
500	0.15
550	0.13
600	0.03
650	0
700	0.01
750	0.1
800	0.21
850	0.41
900	0.60
950	0.70
1000	0.92
1050	1.02
1100	1.1
1150	1.1
1200	1.01
1250	0.9
1300	0.78
1350	0.58
1400	0.38
1450	0.2
1500	0.1
1550	0.01
1600	0

Accordingly, Matlab software has been used to simulate the absorption phenomenon in the light wave range applied, whereas the next section will discuss the result obtained.

V. CONCLUSION

This work presented to accommodate the outage of the water resource in Gulf region and Qatar particularly. The proposal gives a sound to the laser beam station to provide a solution that could contribute to complete the water cycle through laser carrier carry the evaporation gases via pollution layer to reach the condensation layer and complete the process. Due to that, study the light wavelengths consider extremely important to avoid the attenuation phenomenon such as absorption. The result showed the lowest wavelength prone to absorption between 610 nm up to 700 nm and from 1550 nm until 1600 nm. While the highest severely to the phenomenon around 1100 nm up to 1150 nm. Whereas, due to various climates and environmental, the model factor considered crucial to the effectiveness as it considers the refractive index and atmospheric coefficient. The future work will cover the Ozone layer influences when depletion due to manufactured chemicals

CONFLICTS OF INTEREST

The authors of the study have no any conflicts of interest to declare.

RESEARCH AND PUBLICATION ETHICS

In the studies carried out within the scope of this article, the rules of research and publication ethics were followed.

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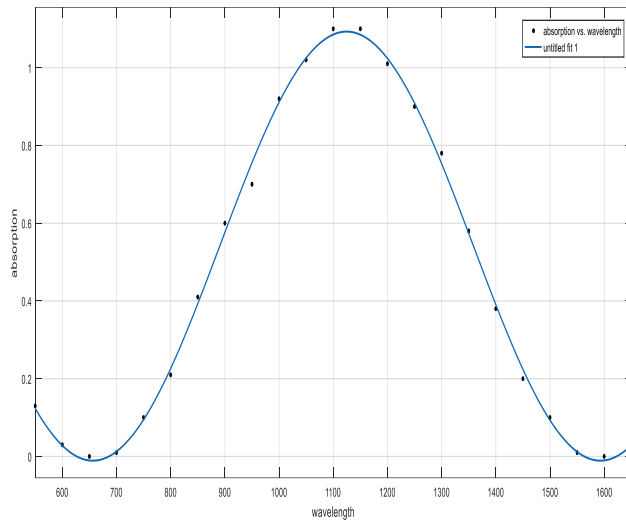


Figure 2: Absorption phenomenon in most common waves

IV. RESULTS AND DISCUSSION

In line with a scientific method, the optical beam station proposed and discussed the capability to control, sense, and analyze in keeping with the atmospheric weather circumstance. While the prediction of the electrical field effects to estimate the force which could apply on the respective air layer.

The specific photon beam has been chosen because of the availability as well as accommodating the most significant wavelengths which are used in remarkably light techniques such as 850, 1310, and 1550 nm. From the beam wavelength analytical point of view, The first slop appeared which indicates the lower absorption from the start of the wavelength range which is 500 nm up to reach 700 nm, while getting undeniable raise from 750 nm which is 0.1 dB continuously until reaching the peak at 1100 to 1150 nm which is 1.1 dB, then starts to slow down with remarkable decreasing into arriving in 1600 nm which is 0 dB and represents the same absorption value at 650 nm, while mathematically the value doesn't mean that is no absorption at all.

The partial stability between 610 nm to 700 nm indicated that easy to see less disturbance in a visible wave. The stability comes again from 1550 nm up to 1600 nm, which could propose a new wavelength to attention. The properties of the blockage layer determine the beam specifications such as power and wavelengths while the electric field surrounding the charge would generate the force that could pass through the layers and hence the accumulation of pollutants gases to reach the condensation layer and complete the process.



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