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“Artificial Rainmaking by using high power laser initiation endothermic reaction, in a way of Natural Lightning Phenomena through Air Craft, in a large scale, in the atmosphere”

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Abstract: After lightning, precipitation is formed by endothermic reaction and ionization process in the atmosphere, it is well known process. These same natural lightning phenomena occur in the atmosphere by high power laser which creates artificial lightning. We intend to create artificial rain by initiating endothermic reactions in the cloud using high power laser pulse which creates artificial lightning through Air Craft.

Natural Lightning Phenomena, practically proved in the laboratory, as high power laser induce condensation & water drops formation and also observed NO & O₃ formation after laser which is endothermic reactions. It is well known that, in the laboratory, high power laser induce condensation and water drops are formed. This novel technology also proved in the atmosphere, “Laser assisted water drops formation in the atmosphere”. Now, it’s used in large scale in the atmosphere by three air craft with high power laser which creates artificial lightning, proposed in this Research Project Proposal

In the atmosphere, after lightning, heavy rain fall occurs. In lightning phenomena condensation takes place by initiating endothermic reactions and water drops formed, these water drops collide with each other due to acceleration and turbulence by wind force to form big rain drops, these rain drops act as natural seeding for another sets of rain drops. In this way, chain process occurs with heavy rain fall.

Above lightning phenomena, may be used for artificial rain making by using high power plasma laser pulse (Technology available in market) in the atmosphere, through Air Craft’s (available in Market).

The advantage of this method is, it is environmentally clean, one time investment so it is economical, can be turned on and off at will, and can be precisely positioned. It will be movable one place to another place easily. It will be used no’s of times and no’s of places, It is one time investment only. Our aim is to create artificial rainmaking by high power laser pulse which creates artificial lightning in the atmosphere, at any place, at any time, as per our human need, for green revolution, in the whole world, If the humidity more than 65% available in the atmosphere. In this proposal, we are presenting “To Design Artificial Rainmaking by using High power laser initiation endothermic reaction, in a way of Natural Lightning Phenomena through Air Craft, in large scale, with needful quantity in the atmosphere”.

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INTRODUCTION

Rain plays an important role in world economy by influencing the agriculture yield. But rain is a natural phenomenon, and it does not fall as and when man needs it. Researchers are trying to create artificial rain for the past many years.

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Current Technology for Artificial rain making is through cloud seeding: -

In 1946 Langmuir produced clouds in a chamber by cooling air with dry ice and gave the idea that nucleation of water would take place by adding some foreign materials as seeds inside the chamber. This idea is being used for more than 60 years for artificial rain creation

By spraying chemicals like silver iodide, calcium chloride and sodium chloride to cold wet air from balloon or aircraft. But the success rate of this method is low. Because in seeding condensation does not take place.

Condensation is the basic need for water drop formation.
Example:

Take two glasses with clean outer surface one with normal water and another with ice pieces and place them on a table in winter season. After sometime you can observe water droplets on the outer surface of the glass which contains ice but not in the other. This is due to the condensation process that occurred in that ice glass without any seeding. Hence condensation is the basic need for the water drop formation. When natural rainfall occurs in the atmosphere there would not be any seeding process takes place.

Seeding process was used only for cold rainy clouds but our process will be used for warm white cloud. In our process, condensation is by endothermic reactions. We have proved this in our Laboratory. Seeding process is expensive and harmful to mankind because it brings harmful chemicals on earth along with rain.

NATURAL EVIDENCES

Our method, actually, emulate rain formation mechanism in nature after lightning. On several occasions it has been found that precipitation follows after lightning. Golde (1977) from a number of radar observations has reported that intense precipitation is not even present in the clouds before the first discharge but it develops abruptly in the same region after discharge from which the lightning flashes originate. Battan (1981) has observed very rapid growth of precipitation particles/ice crystals caused by electrical forces following a lightning discharge. In many cases the on-set of strong electrification follows the appearance of heavy precipitation within the cloud in the form of hail stones (Wallance and Hobbs, 1977). The correlation between lightning and precipitation is as follows: heavy gushes of rain or hail often reach the ground in 2-3 min. after the lightning flash and it is evidenced that lightning is the cause rather than the result of the rapid intensification of the precipitation (Mason, 1975). It is further speculated that the rapid intensification of the precipitation from about 1mm/h to 50mm/h in this 2-3 min period is brought about by a greatly accelerated rate of coalescence of water drops under the influence of electrical forces by a mechanism that is obscure and has no convincing experimental or theoretical base (Mason, 1971). From the above work it is clear that precipitation is formed after lightning.

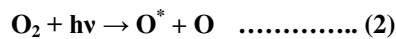
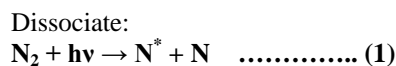
In lightning, temperature rises as high as 30,000K in fraction of a second. At this high temperature both dissociation and ionization of N₂ and O₂ as showed in reactions (1), (2), (3) and (4) take place as fallow. But for the formation of precipitation, a temperature as low as (-10K) is needed. How a region which rose to a temperature of ~30,000K attains a temperature of (-10K)? Who removes the heat? That means after lightning, some mechanism occurs which cool the medium. The mechanism is occurrence of endothermic reactions (5) and (6) which cool the atmosphere. This cooling will create CCN (clouds condensation nuclei) in cloud and produce tiny water droplets in the atmosphere. These tiny water droplets then will act as natural seed for the formation of rain drops in the atmosphere (Drake 2006).

THEORY

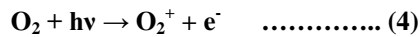
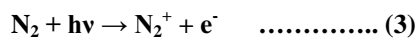
We intend to create artificial rain by initiating endothermic reactions in the cloud using a high power laser pulse through Air Craft remote control system. The advantage of this method is, it is environmentally clean, one time investment, can be turned on and off at will, and can be precisely positioned and cover a cloudy wide area according to atmospheric condition.

When a laser pulse of wavelength, λ and energy, hv (ν = 1/λ and h is Planck’s constant) is shot in the atmosphere, depending on the value of its energy, it can dissociate (break the bonds of) Nitrogen (N₂) and Oxygen (O₂) (which are the

two major gases in the atmosphere) and ionize them as follows:



Ionize:



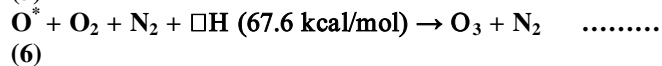
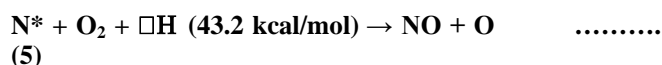
Energy required to dissociate 1 molecule of N₂ and 1 molecule of O₂ = 2.25x10⁻¹⁸ Joule.

Energy required to ionize 1 molecule of N₂ and 1 molecule of O₂ = 4.44x10⁻¹⁸ Joule.

(Calculation has been shown in the Appendix.)

Hence the energy required to dissociate 1 molecule of N₂ and 1 molecule of O₂ is about half of that required to ionize them. Therefore, when a laser pulse is shot in the atmosphere, it will first dissociate N₂ and O₂ and if energy still remains then it will ionize them.

After bond breaking (dissociation, reactions 1 and 2), two atoms of N₂ (N*, N) and two atoms of O₂ (O*, O) are formed. Among them atoms N* and O* are in excited state and hence are unstable. They immediately react with some gases to come to ground state and form stable NO and O₃ as follows:



Both reactions (5) and (6) are endothermic and absorb a large amount of heat (43.2 + 67.6 = 110.8 kcal/mol) from the surrounding air. As a result, the air becomes cooled below the condensation temperature and fine water particles are formed, cloud seeding takes place and it rains. Recently Kasparian group has detected formation of NO and O₃ after laser beam shooting.

There is another possibility. In reactions (3) and (4), positive ions, N₂⁺ and O₂⁺ and electrons, e⁻ is formed. Positive ions, N₂⁺ and O₂⁺ will quickly react with water molecules and form big ions like H⁺(H₂O)_n etc and electrons, e⁻ will quickly react with many gases to form big negative ions like NO₃⁻(H₂O)_n etc. The value of “n” could be as large as 25. These big positive and negative ions may act as seed and create rain.

PRACTICAL EVIDENCES:

Latest Work done:

Carls and Brock (1987) did an experiment in which atmosphere was heated by a laser pulse up to 1600 to 2800 K. They observed water droplet formation in the atmosphere. They postulated that water droplets were

formed by ionization process. This is partly true because they did not consider dissociation and the occurrence of endothermic reactions, which are responsible for cooling and capable of CCN formation. Again in the conclusion of the said paper, he predicted that the air is shock heated to temperatures high enough to cause ionization. If the ionized air is subjected to more radiation, avalanche breakdown of the air can occur. This is similar to breaking of N₂ and O₂ molecules because air contains 77% N₂ and 23% O₂, which is responsible for endothermic reaction and condensation takes place. Our simulation substantiates the theory that shock heating of air can be at least partly responsible for aerosol-enhanced breakdown.

In the laboratory, we did an experiment in a chamber where lightning was created by a high voltage electric spark. We noticed formation of water droplets on the surface of the chamber. The results have been published (Chopkar and Chakrabarty 2008, Chopkar et al. 2010). We have calculate , how much heat energy generated in lightning ,and how much heat energy utilized for breaking the bonds of Nitrogen and oxygen ,also how much heat energy absorbs by endothermic reactions from atmospheric clouds,(S.K.Chopkar,1993)

Chakrabarty D.K., Chopkar S.k.(2009) “Femtosecond terawatt laser system to produce artificial rain”, Presented at 4th International Conference on Computer and Devices for Communication, CODEC 2009 at Kolkata

Braun A., Korn G., Liu X., Du D., Squier J. (1995) *Self-channeling of high- peak power femtosecond laser pulses in air,* Laser induce condensation and water drops formation.

Rohwetter et al. (2010) have shown that ionized filaments (like a cable) generated by ultra-short wave (Visible, Infra Red region) laser pulses are able to induce water-cloud condensation in the sub-saturated atmosphere in the altitude region between 45 and 75m resulting in rain.

Yoshihara et al. (2007) have shown that the pulsed UV-laser irradiation of ambient air induces the formation of water droplets or small ice particles in the laboratory. They also observed that the atomic oxygen which is formed in this process quickly reacts with oxygen molecules to form ozone. In their experiment ozone is formed due to endothermic process by which condensation takes place and CN (condensation nuclei) is formed which produces water droplets or ice crystals.

Petit Y., Henin,S., Kasparian,J. & Wolf,J.-P. (2010) “Production of ozone and nitrogen oxides by laser filamentation.” NO & Ozone formation, these are endothermic reactions which condensation takes place.

J Kasparian¹, P Rohwetter², L Wöste² and J-P Wolf^d (2012) “Laser-assisted water condensation in the atmosphere: a step towards modulating precipitation?” Published *Journal of Physics D: Applied Physics, Volume 45, Number 29*. High power laser induce condensation & water drops formation in the atmosphere.

It may be mentioned here that a group at Indian Institute of Tropical Meteorology, Pune who is experimenting with lieder, has also observed that a few drops of water fall after the laser beam is shot in the atmosphere.

Recently, in U.S.A. at the University of Central Florida in Orlando, Development of this technology (Laser makes rain) was supported by a \$7.5 million grant from the U.S. Department of Defense. During a rainstorm, particles inside a cloud build up static electricity and release it as lightning. Meanwhile, tiny water droplets stick together until they are heavy enough to fall to the ground. Scientists want to recreate this process with lasers to produce rain when and where it is needed (Inside Science TV).

1. In the atmosphere, after lightning, heavy rain fall occurs .In lightning phenomena condensation takes place by initiating endothermic reactions and water drops formed.
2. These water drops collide with each other due to acceleration and turbulence by wind force, to form big rain drops. These rain drops act as natural seeding for another set of rain drops. In this way, chain process occurs with heavy rain fall.
3. Above lightning phenomena, may be used for artificial rain making by using plasma laser pulse (Technology available in market) in the atmosphere, through Three Air craft’s with Controlled system (available in market).

METHODOLOGY

Now, it is clear that as per above discussion, after lightning precipitation formed; in this case, who removes the heat? Means after lightning some mechanism occurs which cool the medium .The mechanism is occurred of endothermic reactions (5) and (6) which cool the atmosphere. This cooling will create CCN in cloud and produce water droplets in the atmosphere. Also, measured in lab “production of Ozone and Nitrogen Oxides by laser filaments “NO & O₃ formation is the endothermic reactions take place which responsible for condensation and water drops formation in the atmosphere.

Also, above natural lightning phenomena, it’s practically proved in the laboratory in clouds chamber ,as “ Laser induce condensation and water drops formation in the clouds chamber in laboratory by Femtosecond –Terawatt laser or Teramobile laser system .These laser technology also practically proved in the atmosphere “Laser- assisted water condensations in the atmosphere”

Above laser technology, it’s practically proved in nature; in laboratory scale as well as in the atmosphere by Femtosecond –Terawatt laser or Teramobile laser system. This laser technology can be used for Artificial Rainmaking in a large scale by ground level or Air Craft system in the atmosphere.

Laser technology used for practical trail in the atmosphere:

Laser technology by femtosecond terawatt or terawatt mobile laser system can be used for practical trail in the atmosphere from hill cloudy area .For this research project, Chikhaldara dist Akola (M.S.)or panchamadi(M.P.),there

are very good place for practical trail purpose from ground level.

Laser technology used for artificial rainmaking in a large scale by Air Craft:

Why? Air Craft System proposed in the Atmospheric Clouds for Rain Making by Laser

If Laser technology used from ground level for artificial rainmaking in the atmosphere:

- a) Laser intensity with high power can not reach up to height 2 to 3 Km in the atmospheric clouds due to loss of laser energy in a way of laser travelling by radiation and conventions process in the atmosphere. So, today's laser technology can not used from ground level for artificial rainmaking in the atmosphere ,unless and until plasma laser pulse designed, which go up without loss of energy in away and exploded up in the atmospheric clouds.
- b) If Laser technology used from ground level for artificial rainmaking in the atmosphere, then natural lightning may be comes through these laser on ground and damages laser instruments with harmful to worker and scientist who was working there.
- c) Laser technology used from ground level for artificial rainmaking in the atmosphere, it's may be covered 3 to 4 Km area in radius from one station .It's can not covered large area as Air Craft system.
- d) Laser technology from ground level can not moves easily from one place to another place, but Air Craft laser system moves at any place easily.

As above discussion it is clear that today's Laser technology can not used from ground level for artificial rainmaking in the atmosphere.

Laser technology used for artificial rainmaking in the atmosphere by Air Craft System in a large scale:

- a) Air Craft are easily available in market also, Femtosecond –Terawatt laser or Teramobile laser system are easily available in market , one time investment , Air Craft laser system moves at any place easily. This system can be used no's of times
- b) Air Craft laser technology, it's cover more than 200Km² area in one time, if humidity than 65% in the atmosphere
- c) Air Craft laser technology directly inserts in to upper atmospheric clouds.
- d) d) Air Craft laser technology, for artificial rainmaking in the atmosphere which creates acceleration and turbulence process in the atmospheric clouds by Air Craft, due to these , small water drops collides to each and form big rain drops .These big rain drops act as natural seeding process by wind force and formed another sets of rain drops, in this way chain process occurs in the atmosphere with rain fall.

So we will propose Air Craft Laser technology in this research project proposal In this system we will used three air craft, in each air craft incite high power technology and each air craft release three to six laser beam in the atmospheric clouds . Distance makes to each air craft 300 m horizontally and 300 m vertically fly in the atmosphere. Three air craft's with high power laser are used in this operation. Three Air Craft goes up Fly in the atmosphere and will release minimum three to six high power laser pulses by each Air Craft in the upper atmospheric clouds. Its cover more than 200Km² area One time investment, used No's of time and No's of places.



Figure. No 1-Three Air Craft fly with high power laser pulse for practically Artificial Rainmaking Project Demonstration in the atmosphere.

Now we proposed model of three air crafts with high power laser system for demonstration in the atmosphere. In each Air Craft There should be fixed camera system and the quad copter by which we can measure the atmospheric parameters when sent to the atmosphere, as shown in Fig. No.2



Figure no 2:- Air Craft with plasma laser pulse & atmospheric parameters measuring camera quad copter instruments fixed to Air Craft.

Design for aircraft with LASER system fixing:

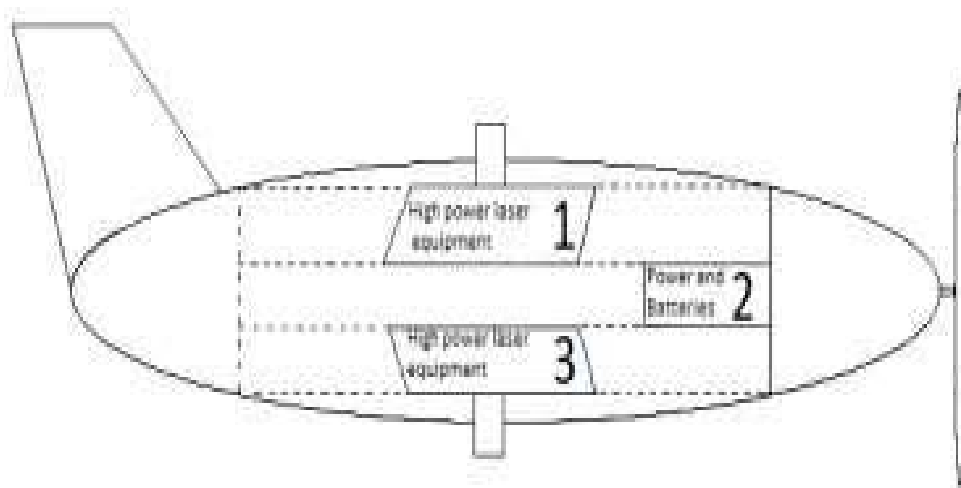


Figure No. 3 "Air Craft Designed position Design for aircraft with LASER system fixing.

Inner space for LASER equipment system in drone aircraft (G+1) – 8.4x4.5x4.5

a) **Size of room in ground floor – 8.5x4.5x2.7**

In ground floor there are LASER units – 2 Nos. as per shown in diagram

b) **Plan for first floor:**

Size of room in first floor – 8.5x4.5x1.8

In first floor there are high powered energy supply unit fixing and batteries and other unit fixing.

In the above diagram item no 1 and 3 are LASER Emitting Devices to control atmospheric clouds for rain making. This is a double LASER unit based at ground floor of the drone. Item no 2 shown in diagram covers entire 1st floor and consists of all the electrical appliances power generating unit and LiPo Batteries along with control station.

LASER PROJECT WITH AIR CRAFT

High Power Plasma laser Pulse Technology machinery with High Power supply set up in Air Craft which will be also control system machinery set up

Description	Angel Rainer
Wing Span	10m
Air Craft Length	20 m
Take off Weight	6500 kg
Engine	Electric motor engine , Four cylinders 115 hp 86 kw
Batteries	LiPo cells
Air Craft Flight Speed	100 km/h with Maximum load of 6500 kg.
Telemetry & command Data link	433 MGz radio, range is 80 km
Max Altitude	3.0 Km to 5.0 Km
Endurance	5 hours maximum
Launch	Airdrome runway 400m X 700m
Control	Automatic
Air Craft Lifetime	5000 flights

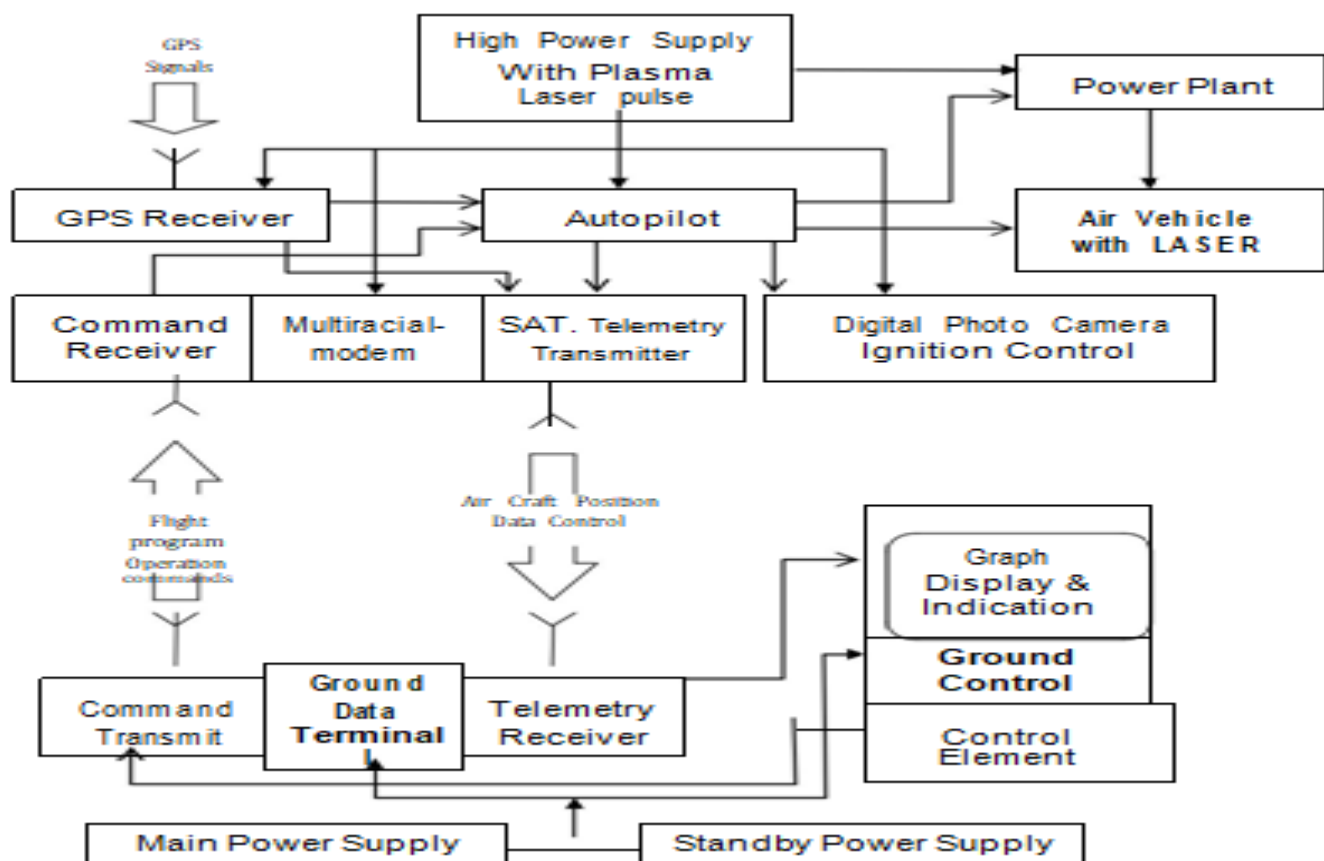


Figure No. 4“Air Craft Designed position

The advantage of this method is, it is environmentally clean, one time investment so it is economical, can be turned on and off at will, and can be precisely positioned. It will be movable one place to another place easily. It will be used No's of times and No's of places, It is one time investment only .Our aim is to create artificial rainfall by high power laser pulse in the atmosphere, at any place, at any time, as

per our human need, for green revolution, in the whole world, If the humidity 65% available or more than in the atmosphere. In this proposal, we are presenting “To Design Artificial Rainmaking by using High power laser initiation endothermic reaction, in a way of Natural Lightning Phenomena through Air Craft, in large scale, with needful quantity in the atmosphere”.

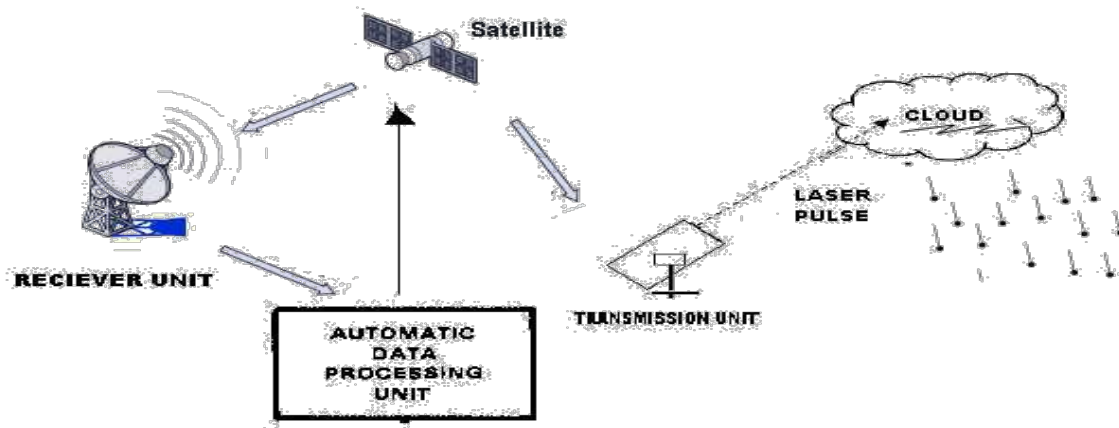


Figure No.5: Future plan for artificial rainmaking by high power laser pulse through transmission unit from ground and control system by satellite

ARTIFICIAL RAIN MAKING SYSTEM DESIGN EXPERIMENT

Recording of atmospheric parameters:

Data to be recorded (before and after passing laser pulse)

Date :: Day :: Time::AMPM Location ::
 INTENSITY OF LASER BEAM= ----- J (wave length λ , nm)

Sr. No.	Heights (mts)	% of Humidity		Wind Velocity		% liquid water content		Temperature		Pressure	
		Before	after	Before	after	Before	after	Before	after	Before	After
1	100										
2	200										
3	300										
4	400										
5	500										
6	Average										

In this way we will record the above parameters by sending a laser of particular Wavelength and then we will vary the wavelength of laser Pulse and record the same Parameters so that we will get the data for ready reference for artificial rain making at that particular place.

Observation of cloud condensation and precipitation formation:

We will record videos and pictures of cloud condensation and precipitation by cameras before, during and after laser induced precipitation.

Measuring liquid water content in the cloud:

Liquid water content in the clouds will be measured by sending quad-opted at various heights (remote controlled from the ground).

Measurement of atmospheric parameters like percentage of humidity, temperature, and pressure and wind velocity at different height before and after sending the laser pulse will be done by weather forecasting system or satellite receiving systems.

Laser experiment:

After recording atmospheric parameters and water content of the clouds on any given day at a particular date, time and location; we will start our experiment by sending different wavelength of lasers and recording the resulting precipitation using rain gauge. Or video camera from Air Craft

For example, on a given day after recording percentage of humidity, temperature, and pressure and wind velocity; we will send laser pulse of various intensity and different wavelengths and note the resulting precipitation. We will get the following information:

INTENSITY OF LASER BEAM= --
 --- nm (wave length λ)

Sr. No.	Horizontal distance of rain gauge station from laser instrument in Meter	Rain fall in mm
1	200	
2	400	
3	600	
4	800	
5	1000	
6	1200	
7	1400	
8	1600	
Average Rain fall in (mm)		

In this way we will record the above various parameters by passing a laser pulse of particular wavelength and then we will vary the wavelength of laser Pulse and will record the average rain fall at different rain gauge stations so that we can get the optimum value of wavelength and intensity of the laser Pulse which will give the maximum average rain fall.

ANALYSIS

At any given level of humidity range, we will have the data of laser intensity (wavelength) versus % of water drop formation. After calculating optimum laser intensity at a given humidity range, we will analyze the relationship between humidity range and optimal wavelength to cause precipitation at that humidity range. This reading will help us design the final laser induced rain making system optimized to cause maximum possible rainfall at a given level of humidity.

CONCLUSIONS

- a) Natural Lightning Phenomena, practically proved in the laboratory, as high power laser induce condensation and also observed NO & O₃ formation after laser shouts in clouds chamber which is endothermic reactions. It is well known that, in the laboratory, high power laser induce condensation and water drops are formed, But can these water particles, be converted in to big size rain drops in the atmosphere ?.....yes!
- b) In the atmosphere, after lightning, heavy rain fall occur. In lightning phenomena condensation takes place by initiating endothermic reactions and tiny water drops formed these tiny water drops collide with each other due to acceleration and turbulence by wind force to form big rain drops, these rain drops act as natural seeding for another sets of rain drops. In this way,

- c) chain process occurs with heavy rain fall (Chopkar S.K.2013).
- c) Now it is clear that the water drops formed after lightning/Laser is due to condensation by endothermic reaction' these natural lighting phenomena can be used for artificial rainmaking by using high power laser through Air Craft control system in the atmosphere, If the humidity 65% available in the atmosphere(Chopkar & Chakarbarti2014).
- d) If the power of laser is increased to petawatt (10¹⁵ watts) or exawatt (10¹⁸ watts) level it is possible to create larger water droplets. These powerful lasers are commercially available.
- e) After sending high power laser pulse through Air Craft control system. We intend to create water rain drops by initiating endothermic reactions in the parcel cloud these new raindrops will again act as natural seeding. In this way, chain process occurs to give maximum artificial rainfall, which will be commercially used for domestic and industrial purposes.
- f) If materializes, our future plan is to fixed data in the computer software and providing same to satellite (Fig.4) for causing maximum rain fall at any place, at any time, as per our human need, for green revolution, in the whole world ,If the humidity 65% available in the atmosphere
- g) This process is economical, harmfulness, eco-friendly and can be switched on and off. It is most useful for human being, particularly for farmers. Hence suicides of farmers can be stopped. Also, This methodology its cover more than 200 Km² area One time investment, used No's of time and No's of places (Chopkar S,K,2012).
- h) One additional use of this process is that the excess rainfall may be stopped by the same Air Craft system by releasing low intensity laser into the clouds in the

atmosphere during excess rainfall which will make the excess rain clouds to evaporate and will make them disappear from the excess rainfall area.

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APPENDIX

The energy of a laser beam of wavelength λ is $h\nu$ ($\nu = 1/\lambda$ and h is Planck's constant). We will shoot laser pulse in the atmosphere and dissociate (break bonds of) N_2 and O_2 as follows:



Bond energy of $N_2 = 226$ kcal/mole.

1 cal = 4.184 Joule, Avogadro number = 6×10^{23}

Therefore energy required to break 1 molecule of N₂ = 226x10³x4.184/(6x10²³) = 1.58x10⁻¹⁸ Joule. Bond energy of O₂ = 96 kcal/mole.

Therefore energy required to break 1 molecule of O₂ = 96x10³x4.184/ (6x10²³) = 0.67x10⁻¹⁸ Joule.

So the total energy required for breaking 1 molecule of N₂ and 1 molecule of O₂ will be (1.58x10⁻¹⁸ + 0.67x10⁻¹⁸) = 2.25x10⁻¹⁸ Joule.

When a laser pulse is shot in the atmosphere, it may ionize N₂ and O₂ as follows:



Ionizing potential of N₂ = 15.58 ev = 2.49x10⁻¹⁸Joule

Ionizing potential of O₂ = 12.2 ev = 1.95x10⁻¹⁸Joule.

So the total energy required to ionize 1 molecule of N₂ and 1 molecule of O₂ is 2.49x10⁻¹⁸Joule +1.95x10⁻¹⁸Joule = 4.44x10⁻¹⁸ Joule.

The above calculation shows that the energy required to dissociate 1 molecule of N₂ and 1 molecule of O₂ is about half of that required to ionize them

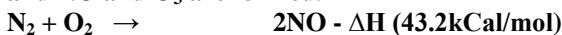
FLOW CHART FOR NOVEL TECHNOLOGY TO CREATE ARTIFICIAL RAIN MAKING BY PLASMA

Laser pulse in a way of Natural lightning phenomena.

* It is well known that after lightning precipitation is formed and heavy rainfall occurs. These Lightning phenomena cause by endothermic reactions

❖ Lightning creates high temperature; at high temperature bonds of Nitrogen N₂ (78%) and Oxygen O₂ (21%) break out into excide N* and excide O*.

❖ These excide N* and excide O* react to each other and NO and O₃ are formed.



❖ After NO and O₃ formation endothermic reactions take place. In these endothermic reactions large amount of heat energy is absorbed from the surrounding atmospheric clouds. Condensation take place in the atmosphere .Condensation is the basic need for water drops formation.

❖ After that Condensation takes place and precipitation is formed with heavy rainfall after lightning. It is a well-known process in the atmosphere.

❖ These natural lightning phenomena will be used for artificial rainmaking by using plasma laser pulse initiating endothermic reactions in a way of natural lightning phenomena in the atmosphere.

❖ These natural lightning phenomena were practically proved in the laboratory as well as in the

▪ **Atmosphere up to 30m height.**

❖ These natural lightning phenomena were practically proved in the laboratory as High power laser induce condensation and observed NO & O₃ formation after laser shouts; which are endothermic reactions.

❖ High power laser induce condensation and tiny water drops are formed practically in the laboratory experiment.

❖ These tiny water drop particles are converted into rain drops by acceleration and turbulence due to wind force in the atmosphere.

❖ In foreign countries above technology is practically proved and successfully experimented and is known as “Laser makes rain”.

❖ Recently in Florida University, USA, 7.5million dollar was sanctioned for developing this novel technology.

❖ In India, we would like to start” International Rainmaking Research Centre” for development of this technology under Government of India.

❖ Project proposal is ready “To design artificial rainmaking system by plasma laser pulse initiating endothermic reactions in a way of natural lightning phenomena through Drone Aircraft remote control in the atmosphere.

❖ This process is economical, harmfulness and eco-friendly and can be switched on and off by remote control from the ground. It is most useful for human being, particularly for farmers. Hence suicides of farmers can be stopped.

❖ Please search on Google web as “Artificial Rainmaking by Endothermic reactions “ or visit our web site www.arrindia.org

❖ This technology is awarded National and International patent. Our research paper has been published in National and International Journal.

❖ Refer publish research paper “Artificial Rainmaking system” in international journal of meteorology www.ijmet.org and other national and international publication research papers also.

❖ Our aim “When and where, artificial rain making as per human needs for Green revolution in the whole world”, If the humidity 65% available in the atmosphere.

❖ One additional use of this process is that the excess rainfall may be stopped by the same drone system by releasing low intensity laser into the clouds in the atmosphere during excess rainfall which will make the excess rain clouds to evaporate and will make them disappear from the excess rainfall area.