

“Innovative Rainmaking Technology”

A. Demonstration of Innovative Rainmaking Technology on Laboratory Cloud Chamber By IRRA Scientist Group, India:

- **Rainmaking Technology:** Research work on "Innovative rainmaking technology by Laser system as similar natural lightning phenomena from ground level" is scientifically and practically proven in laboratory cloud chambers as well as in the atmosphere. Innovative rainmaking technology is most useful for the "Green revolution in the whole world for all human beings". IRRA scientists aim for rainmaking by laser system at any place, any time, as per human needs for rainfall in the atmosphere. There is more than 60% humidity in the atmosphere. This is God's gift to us for a green revolution in the whole world for all human beings.
- **Request:** If any government/organization is ready for demonstration/experiment on a large scale on "Innovative rainmaking technology", the IRRA scientist group is happy to work with them. Your valuable suggestions and guidance with scientific comments are solicited and welcome.
- **Theory:** To generate a high temperature, a laser beam must be fired into the cloud region of the atmosphere. This high temperature will break the bonds of N_2 and O_2 molecules in the atmosphere and produce N and O atoms. These atoms will be in an excited state (N^* , O^*). They are extremely unstable and achieve a stable ground state by sucking heat from the cloud region through endothermic reactions (such as NO and O_3 formation). As a result, the temperature of the cloud region decreases, condensation takes place, water drops form (condensation is the basic need of water drop formation), natural seeding is created, and it rains. The result has been published in <http://www.indjst.org/vol/1/No/6> (Nov.2008) "Artificial Rainmaking system in a Way of Natural Phenomena".
- **Practical:** In this demonstration, lightning phenomena are created by high power voltage electric sparks as positive and negative sparking in the glass chamber, as shown in the published research paper <http://www.indjst.org/vol.1/No.6> (Nov.2008) "Artificial Rainmaking system in a Way of Natural Phenomena"). create artificial lightning in a glass chamber, in the cloud chamber, at the Sugar Sahakari Factory, Malegaon Tal., Baramati, Dist.-Pune, Maharashtra, India.
- **Result:** This experiment suggests that water droplets form as a result of endothermic reactions during the artificial lightning created in the glass chamber. Condensation is the basic need of water drop formation, which was proved by the IRRA Scientist Group on a laboratory scale as follow. Demonstration of Innovative Rainmaking Technology in a Laboratory Cloud Chamber at Malegaon Sugar Factory, Dist. Baramati (PUNE) under Pune University, Pune Physics Department, Pune University. IRRA Scientist Group, India has collected funds from our own pockets for this demonstration/experiment on laboratory scale by IRRA Scientist Group at Malegaon sugar factory, Malegaon, Dist.-Baramati, (Pune), and Maharashtra, India.

- ***Condensation is the Basic Need for Water Drops Formation:***

We have done an experiment in IRRA Laboratory, (2020), Sevagram, Dist.-Wardha. The result has been published in an international journal. That condensation is the basic need for water drop formation can be understood by taking two glasses, one filled with normal water and another with ice pieces. After some time, one can observe water droplets on the outer surface of the glass that contains ice but not on the inside. This is due to the condensation process that occurs around the ice glass. So, the IRRA Scientist Group proposed a laser system for this research project to create artificial lightning by the initiation of endothermic reactions, similar to natural lightning phenomena, for artificial rainmaking. As a result of these reactions, the temperature drops, condensation occurs, precipitation form with natural seeding occurs, and rain falls in a manner similar to lightning-caused rain. This process has been practically proved in the laboratory and atmosphere as "production of ozone and nitrogen oxides by laser filamentation".

- ***Rainmaking Technology Proved as Scientifically & Practically in laboratory Cloud chamber as well as in the atmosphere:***

- *Several attempts have been made by various researchers to create artificial rain by laser system: (Practical Evidences for Rainmaking Technology)*
- **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 develops abruptly in the same region after discharge from which the lightning flashes originate.*
- **Carls and Brock (1987) heated the atmosphere with a laser pulse up to 1600 to 2800K and observed water droplet formation. They predicted that high temperatures cause ionization of N₂ and O₂ and that, when this ionized air is subjected to more radiation, an avalanche breakdown of air can occur.*
- **Braun et al. (1995) have observed laser induced condensation and water drop formation by shooting self-channeling of high-peak power femtosecond laser pulses in the air.*
- **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 [O] formed in this process quickly reacts with O₂ molecules to form O₃.*
- **Rohwetter et al. (2010) demonstrated that ionised filaments generated by ultra-short wave laser pulses induce water-cloud condensation in the sub-saturated atmosphere between 45 and 75 metres altitude. A team, called terra-mobile-group (TMG), consisting of scientists from Switzerland, Germany, and France, has been trying to create artificial rain by laser (Kasparian et al. 2000; 2003; Mejean et al. 2006; Rohetter et al. 2010; Kasparian et al. 2012). They have done simulation experiments in a laboratory cloud chamber and have observed condensation and water drop formation. They also succeeded in producing tiny water particles in moderately humid air at an altitude of 45 to 75 m in the atmosphere using a terawatt mobile laser. But the droplets were about a hundred times too small to fall as rain; instead, they remained*

suspended in the air. The team feels that it is feasible to get larger droplets if the power of the laser is increased to a petawatt (10^{15} watts) or exawatt (10^{18} watts). They further say that the effectiveness of this method is much easier to gauge than traditional cloud-seeding techniques and that it could provide a practical means of triggering rainfall. (Search Google as 'Laser makes rain, heavily '2010).

- **A group of scientists from Florida University also observed water drop formation by a high power laser shooting experiment. It appears from the above that the laser has not yet succeeded in producing artificial rain. In this paper, a novel method is described to create artificial rain by laser.*
- ***Methodology for Artificial Rainmaking by Laser system from Ground:***
- *In this experiment, a femtosecond–terawatt laser creates artificial lighting in the atmosphere up to 1.2 km to 1.5 km altitude in the white warm cloud regions. These warm white clouds are converted into black rainy clouds with natural seeding for rain enhancement in the atmosphere.*

A laser pulse will be sent to the cloud to initiate endothermic reactions that will create lightning phenomena, as in nature, mentioned above. The laser technology for this purpose, though not fully developed, already exists. For example, a German-French group has used a femtosecond–terawatt laser to obtain "Laser-assisted water condensation in the atmosphere." They have succeeded in obtaining raindrops from an altitude of 45 m to 75 m in the atmosphere.

*This novel rainmaking technology can be used for white, warm clouds too, which get converted into black rainy clouds for rain enhancement. * as well as the formation of water droplets by high power laser shooting. A Florida University scientist observed that "laser makes rain."*

As per report, a group of European scientists working on artificial rain said in 2010, "Firing extremely powerful laser pulses through humid air can stimulate the formation of clouds, according to a team of European scientists." They say that the effectiveness of this method is much easier to gauge than traditional cloud-seeding techniques and that it could provide a practical means of triggering rainfall. (Search Google as 'Laser makes rain, heavily '2010)

In Indian ancient tradition, there is a mention in Vedshastra that "Fire arrows are sent towards the atmospheric clouds, which are responsible for prompt rainfall."

Our system could be a terawatt femtosecond Ti: sapphire pulse laser. Its fundamental wavelength could be 800nm. The pulse will be 500 mJ in energy, 120 fs in duration, and 10 Hz in repetition frequency. The laser pulse has to propagate with almost high peak intensity over a distance of 1km. It works when more than 65% humidity is present in the atmosphere. Our findings could be used by scientists and engineers to create artificial rain through a new method. The results could be of immense benefit to human beings.

This laser system can be operated from the ground as well as from an aircraft. A laser system can be operated from the ground in this experiment, using innovative rainmaking technology in the atmosphere, as shown in Fig. No 1.

A laser pulse has to be sent into the atmosphere to reach white warm cloud regions at about 1.2 km to 1.5 km altitude. It will initiate endothermic reactions that will create lightning phenomena and rain, as in nature. These warm white clouds will be converted to black rainy clouds with natural seeding for rain enhancement in the atmosphere.

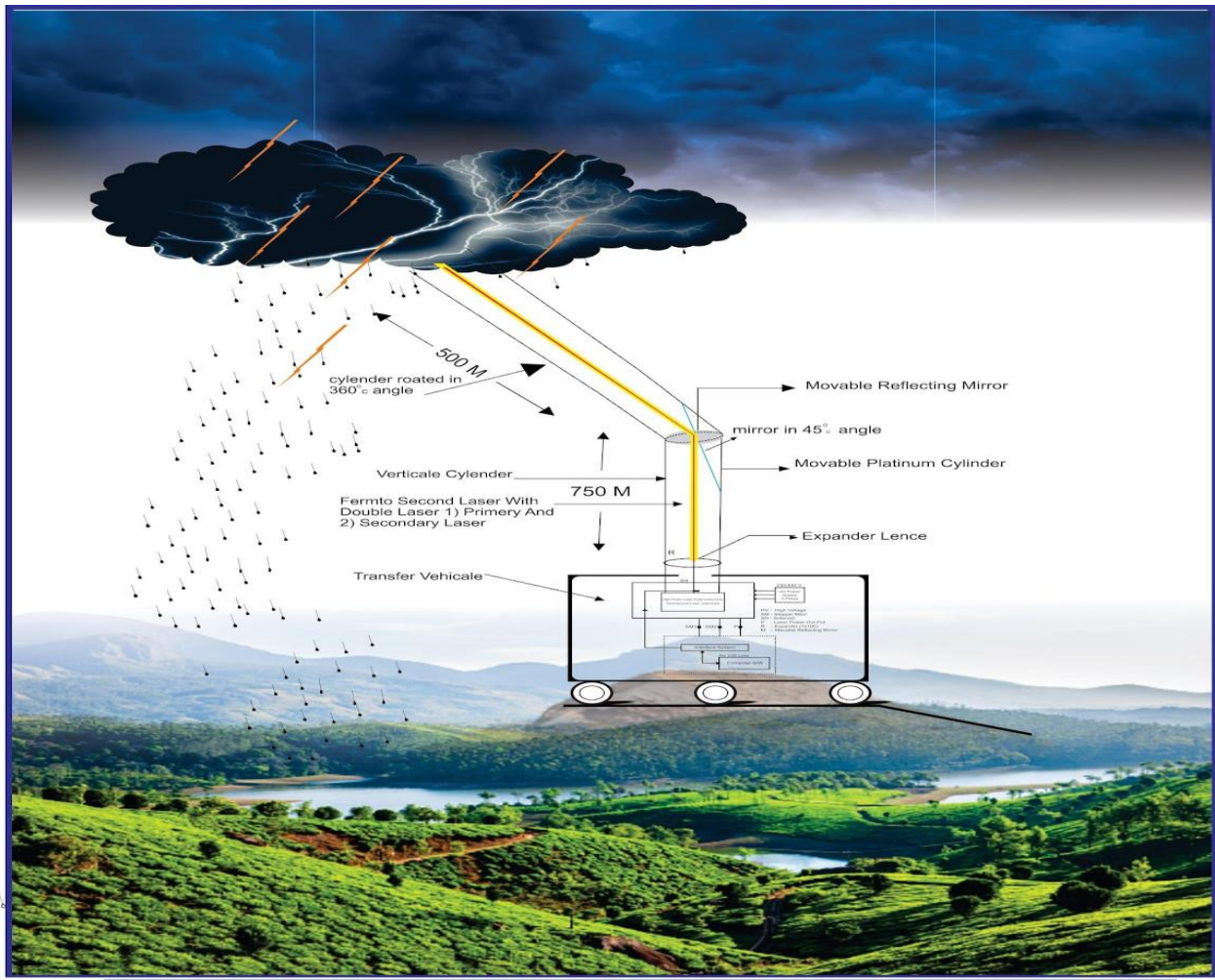
This laser system can be operated from the ground as well as from aircraft. Plans to operate from the ground are shown in Figure No.1. When operated from the ground, the covered area on the ground could be 5 km to 7 km in radius. Fig. 1 shows a plan to use two lasers. In this figure, a terawatt femtosecond Ti: sapphire pulse laser with double coarse laser, (1) primary laser and (2) secondary laser, is shown. In this system, secondary laser energy is used for laser pulse travelling purposes and primary laser energy is used for creating artificial lightning in the upper atmosphere up to 1.2Km to 1.5Km altitude for the initiation of endothermic reactions. A lot of heat energy is absorbed from surrounding atmospheric clouds, condensation takes place, and water drop formations in the atmosphere. It's used as a natural seeding process to form another set of raindrops. The chain process occurs for rain enhancement in the atmosphere.

Innovative rainmaking technology using laser systems from ground level can be used in the field by farmers. It can cover an area of more than 7 km in radius in a wind direction in the atmosphere as per Fig.No.1.

- *For this experiment, a hilly area must be selected on the field of a farmer, with a high power electric supply point already managed near the experiment site. A high-power laser system must be placed in a 12 wheel truck so that it becomes easy to transport it from one place to another. When the upper atmosphere is cloudy and more than 65% humidity is present in the atmosphere, the experiment can be started in the field of the farmer. We will measure atmospheric parameters such as humidity, temperature, pressure, wind velocity, wind direction, etc. at ground level as well as at the upper level. For this purpose, a separate unit/department must be established as the "Measuring & Maintaining Department". After the success of the experiment, all related data must be put into software computers for analysis and conclusion, with a fixed perfect laser design for maximum rainmaking/rainfall in the atmosphere.*

In this way, "Artificial Rainmaking Methodology by Laser System from Ground" can be used for a Green Revolution in the whole world for all human beings.

Figure: "Artificial Rainmaking Methodology by Laser system from Ground" (Figure No.1)



Artificial Rainmaking By Laser System From Ground Level Fig : 1