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Mathematical Model To Find The Acceleration Of Rain Drop Cluster In Presence, Absence Of Sun And Effect It On Living And Non Living Being

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Abstract: *The objective of these work is to compare the effect of sun or sunlight on rain drop or rain drop cluster in presence and absence of sun. By comparing of these two condition, we can aware the people for the precaution and safety. Because the effect of rain drop cluster is different in presence and absence of sun. Here, We have develop a mathematical model and compare the acceleration of rain drop cluster towards the gravity in absence and presence of sun for the effect. During the comparison, We found the net acceleration towards the gravity in presence of sun is less than in absence of sun (i.e. $a_{AS}>>a_{PS}$). Since, we know the force is directly proportional to acceleration keeping mass constant from newton second law of motion, then from our mathematical relation, force carried by cluster in presence of sun is less than in absence of sun. Therefore, we concluded that the materials and living being get hurt more by cluster of rain drop, when raining occur in absence of sun than presence.*

Hence, In this way we can aware the people about the effect of rain drop cluster in presence and absence of sun and can save the living being from the damage or effect made by rain drop cluster in absence and presence of sun.

Keywords: *Acceleration, Net Acceleration, Force, Presence and Absence of Sun, Rain Drop Cluster etc.*

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I. Introduction

In this paper, We have developed a mathematical model to show the acceleration of rain drop cluster in presence of sun is less than the acceleration of rain drop cluster in absence of sun, for same mass of rain drop cluster.

In presence of sun, rain drop of cluster goes some extra phenomena than that of absence of sun light like scattering of rays, absorption of light or specific heat capacity and transmission of light etc. but these phenomena is not take place in absence of sun.

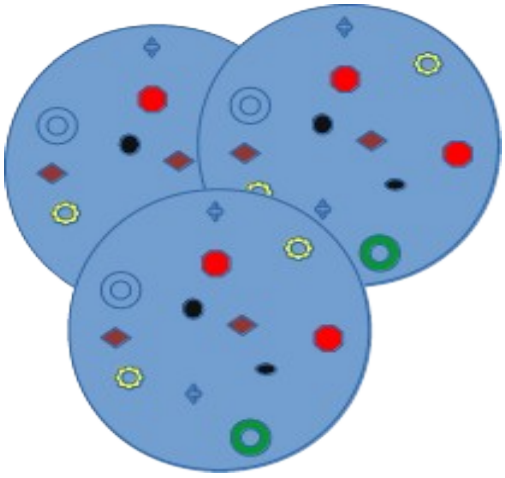

Figure 1: Rain drop cluster in absence of sun.

These extra phenomena is consider here, and the role of these are developed in methodology and cause to decrease the acceleration towards the gravity, in our cases in this paper.

Note: Here, the small structure inside the cluster with different color, shape and size etc. indicates impurities contain in rain drop cluster or small particles contained by consider rain drop cluster.

In absence of sun, the rain drop cluster accelerated towards gravity as normal as other object falling towards the earth surface from atmosphere. During thisonly little change take place on the cluster. In our case cluster is ideal that is no change in mass of cluster for both cases (absence and presence of sun) but change in shape, size and vibration is considerable which is major parameter to compare the acceleration towards gravity.

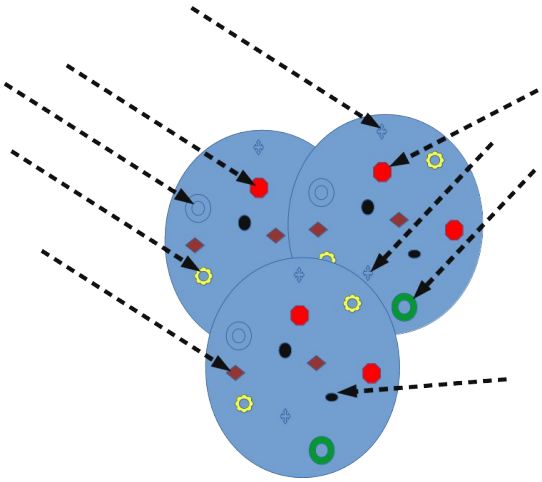

Figure 2: Rain drop cluster in presence of sun.

Note: Here the small structure inside the cluster with different color, shape and size etc. indicates impurities contain in rain drop cluster or small particles contained by consider rain drop culsterand black dash with arrow indicate incidence of sun rays.

In presence of sun, the rain drop cluster accelerated towards gravity arenot normal as other object falling towards the earth surface from atmosphere or like rain drop cluster in absence of sun. In presence of sun, some more extra change take place in cluster of same mass in both cases, include the change on rain drop cluster in absence of sun. So if we consider whole the system in presence of sun the more change take place in rain drop cluster than that of absence of sun. The total change of cluster that is in shape, size and vibration, for same mass of cluster in the presence of sun is more than that of absence of sun. Here, change is shape and size indicate the increasing in radius of the rain drop cluster and vibration indicate increasing the oscillation of cluster after absorption energy. These change or increase parameter in presence of sun is more. So, the resistance on falling the rain drop cluster towards the gravity is more and hence acceleration is less in presence of sun than absence of sun.

The H_2O molecule is electrically neutral, but the positive and negative charges are not distributed uniformly. This is shown clearly by the gradation in color from green to purple. The electronic (negative) charge is concentrated at the oxygen end of the molecule, owing partly to the nonbonding electrons (solid blue circles), and to oxygen's high nuclear charge which exerts stronger attractions on the electrons. This charge displacement constitutes a electric dipole. One can think of this dipole as the electrical "image" of a water molecule.

The forces acting on water molecules are a combination of long-range and short-range forces. The long-range forces act over distances greater than 3 Å and consist of electrostatic, induction and dispersion forces. At these large separations electrostatic forces predominate. These arise from permanent electric moments of the molecules and the interaction of their dipoles. It is because of this dipole interaction that the orientation of the molecules will determine whether the electrostatic forces are attracting or repelling. The potential energy for a single water molecule can be taken as

$$\phi(r_1, r_{2,}\theta) = \frac{e^2}{r_{12}} + \phi_{OH}(r_1) + \phi_{OH}(r_2) - \frac{1}{2}e^2\alpha\frac{\left(\left[1-K(r_1)\right]\left[1-L(r_1)\right]\right)}{r_1^4} + \frac{\left[1-K(r_g)\right]\left[1-L(r_g)\right]}{r_2^4} +$$

$$\frac{-1}{2}e^2\alpha\left(\frac{\left[1-K(r_1)\right]\left[1-L(r_2)\right]+\left[1-K(r_2)\right]\left[1-L(r_1)\right]}{r_1^2 r_2^2}cos\theta\right),$$

where r_1 and r_2 are the OH bond lengths, r_{12} is the HH distance, and e is the HOH bond angle[1]. The force due to radiation pressure on certain surface is given, $F_{rad}=\pi a^2<Q_{pr}>\Delta u_{rad}$, where a is the grain radius and is the net

energy fux in the Δu_{rad} radiation field the total energy density, for a ($\Delta u_{rad}=u_{rad}$,) unidirectional radiation field and for an isotropic ($\Delta u_{rad}= 0$) radiation field and Q is spectrum-averaged radiation pressure efficiency factor[2].

II. Review

Water molecules connected with a network of hydrogen bonds to form and a drop of water molecules form by the combination of such network bond. Each individual water molecule is assumed to carry a considerable dipole moment, which is significantly larger than that of a free water molecule due to collective effects. Dipole moment of a water molecule in water medium is about 2.8–2.95 Debye (D) and 1.85 D of a free water monomer. This dipole also play an important role for the formation of rain drop cluster[3,4,5,6]. Water is the main source of energy and amazing capability of eukaryotic cells to break or dissociate the water molecule was unsuspected to us because it takes 2000˚C degrees to dissociate water[7]. The adsorption of molecules on the surfaces of solids is an important step in many processes. A molecule that collides with a surface of a crystal can get trapped, if it loses enough of its kinetic energy to the lattice and thereby becomes attached to the surface. If the energy transfer is not fast enough, the molecule will be reflected back into the gas phase[8].

By scanning the energy of the IR laser over the vibrational mode energies of the surface molecules and monitoring the generated sum frequency signal at $\omega_{SF}= \omega_{IR} + \omega_{vis}$, a vibrational spectrum of the interfacial molecules is obtained. VSFS has advantages over linear spectroscopies, because it is highly specific to the thin layer of molecules within the interfacial region. Since VSFS is a coherent spectroscopy, each oscillator's contribution to a response has an associated phase that can interfere constructively or destructively with adjacent modes, making analysis and spectral assignments challenging[9]. The radiation reaction force on an oscillating electric charge e can be written, $F_{rad} = (\mu_0 e^2/6\pi c)\dot{a} = -(2\omega^2 r_e/3c)mv = -\omega^2\tau_0 mv$, where $r_e = e^2/4\pi\epsilon_0 mc^2 \approx 3 \times 10^{-15}$m is the classical electron radius, and $\tau_0 = 2r_e/3c \approx 7\times10^{-24}$ s [10]. For a gas or vacuum the index is one and for x-ray, the refraction index of liquid or solid is $1- \delta + i\beta$, δ ranging from 10^{-6} to 10^{-5} and the absorption coefficient β ranging from 10^{-11} to 10^{-10} [11].Light scattering-based methods are used to characterize small particles suspended in water, in a wide range of disciplines ranging from oceanography, through medicine to industry. The fundamentals of the interaction of light with condensed matter, followed by an extended discussion of the basic optical properties of pure water, seawater etc., and the physical principles that explain them. The results of measurements of light scattering and of the key properties of the particles: size distribution, refractive index (composition), structure, and shape[12].

A water molecule is formed by two strong OH covalent bonds (∼ 5 eV). Each of these bonds share electrons as oxygen atom is much more electronegative that hydrogens. This creates an asymmetry in the electronic charge distribution as the oxygen tends to retain more negative charge, that is redistributed towards its lone pairs. The attraction contributes to the intermolecular hydrogen-bond that occurs from the hydrogen of one molecule to the oxygen of another molecule. The relatively weak ($E_{H-bond} \sim 0.25$eV) compared to the intramolecular covalent OH bond[13]. The hydrogen-bond network of water is perturbed by the incorporation of a urea molecule, as one of the models explaining protein denaturation by urea is built on the assumption that urea strongly alters the hydrogen-bond structure of water[14]. Light transmission through a water sample is determined by physical properties such as particle size, shape, suspended solids concentration, and composition, and chemical properties such as the presence of near infrared absorbing dissolved matter. The absorption of light by dissolved matter can affect light-scattering measurements by 10% to 50% in runoff from mine tailings[15].

The isolated water molecule has maximum first absorption band is near 7.5 eV in the gas phase, corresponding to a transition that promotes an electron from the highest occupied non-bonding valence orbital to an unoccupied anti-bonding orbital with significant Rydberg character. The second excited state corresponds to a transition from the next highest valence orbital and also dissociates along an OH bond. Much less is known about the excited state dynamics of liquid water, although a shift of the first absorption band by about 0.7 eV to higher energy[16]. The pressure difference produces a drag force, F_D: $(C_D A\rho v^2)/2$, where A is the projection of area of the object normal to the velocity, and C_D is a dimensionless constant[17].

III. Method and Material

When sun light passes from transparent medium having high refractive index, the speed of the light goes on decreasing implies looses of energy and due to this looses of energy, molecules or medium goes on the vibration and looses its original speed in the medium through which it passes. On passing through the medium, it disturbance the system of the molecules which causes the change on speed of molecules system like shape, size and internal distribution system. This changes take place in the presence of sun and causes the change on acceleration towards the gravity of rain drop cluster. The theory is develop below for both cases i.e. in presence of sun and in absence of sun for rain drop cluster. In our consideration system, rain drop cluster has not pure water molecules that means cluster is impure as shown in figure 1 and figure 2 and contain the parties on it clusters and these particles in clusters are also play an important role for effecting the factors in presence of sun.

Theory: To develop the relation for the rain drop cluster water molecules, we have following assumption or condition which help to compare the cases of rain drop cluster in absence of sun and in presence of sun and help us to understand the physics behind it.

Some Assumption are given below:

- Mass of rain drop cluster is same in both cases (in presence and absence of sun).
- Medium and gravity is same for both cases.
- Direction of falling rain drop cluster in downward (towards the gravity).

Cases I : Resultant acceleration of rain drop cluster in absence of Sun to wards the gravity:

Let c=Velocity of light, v= Velocity of rain drop cluster falling under the gravity, g= Acceleration due to gravity towards the earth surface, M= Mass of rain drop cluster containing small minutes particles in it, V= volume of consider cluster, $\rho_{cluster}$ = Density of consider cluster. Then, the force acting downward on cluster is force due to gravity and given by F_{grcd}=Mg and Since we have, (ρ=M/V) then we can write,

$$F_{grcd} = \rho_{cluster} Vg \text{……...(1)}$$

F_{grcd} is the force due to gravity of rain drop cluster on downward in absence of sun. This is the equation (1) of rain drop falling under gravity on absence of sun. Here, we also call this case as the rain drop of rain in absence of sun falling downward.

Let us consider raining on night or absence of light or sun light. If A is the surface area of spherical cluster and ρ_{air} is density of air through it passing, then force against gravity or air resisting the cluster of rain drop towards the gravity is given

$$F_{rrcd} = \frac{A v^2 \rho_{air} C_{air}}{2} \text{…….(2)}$$

Where, C_{air} = Air friction coefficient, ρ_{air} is density of air or atmosphere, and F_{rrcd} is force resisting the rain drop cluster to fall downward. Now from equation (1) and (2), We have net force acting towards the gravity in absence of sun is given as

$$F_{ND} = F_{grcd} - F_{rcrd}$$

$$F_{ND} = Ma_{ND} = F_{grcd} - F_{rrcd} \qquad \text{[F=Ma]}$$

$$Ma_{ND} = Mg - F_{rrcd}$$

$$a_{ND} = \frac{Mg}{M} - \frac{F_{rrcd}}{M}$$

$$a_{ND} = g - \frac{F_{rrcd}}{M}$$

$$a_{ND} = g - \frac{A v_{AS}^2 \rho_{air} C_{air}}{2M} \text{……..(3)}$$

Where a_{ND} is net acceleration of rain drop cluster acting downward. This is the equation (3)for net or resultant acceleration of rain drop towards the gravity in absence of sun in term of mass, whenpassing through atmospheric air resistance by ρ_{air}.

Here, We are considering the shape of rain drop cluster is spherical then, volume and surface area of sphere becomes

$$Volume(V) = \frac{4\pi r^3}{3} \text{…….(4)}$$

$$Area(A) = 4\pi r^2 \text{……...(5)}$$

Where r= radius of considerable cluster of rain drop.

Putting the value from (4) and (5) in (3) we get

$$a_{ND} = g - \frac{4\pi r^2 v_{AS}^2 \rho_{air} C_{air}}{2 \times \frac{4\pi r^3 \rho_{AS}}{3}} \text{…….(6)}$$

$$a_{ND} = g - \frac{3 v_{AS}^2 \rho_{air} C_{air}}{2 \rho_{AS} r}$$

$$a_{ND} = g - \frac{\beta v_{AS}^2}{\rho_{AS} r} \text{……...(7)}$$

This is the net acceleration acting downward in absence of sun, in term of radius and density.

$$\text{and } \beta = \frac{3\rho_{air} C_{air}}{2}(say) \text{……...(8)}$$

Here β are constant since, ρ_{air} and C_{air} is constant for consider medium and we are considering the same medium of both cases i.e. in presence or absence of sun for rain drop cluster.
Also ρ_{AS} is density of rain drop cluster in absence of sun and cluster is composition of numerous particles (dust particles) in it cluster. Equation (7) is the net or resultant acceleration of rain drop in absence of light or sun.

Case II: Resultant acceleration of rain drop cluster in presence of Sun to wards the gravity: In this case, we consider the rain drop cluster falling towards the gravity in presence of sun. When the cluster is falling towards the gravity in presence of sun then some of the changes take place in the cluster of rain drop, they are due to absorption, transmitted and scattered phenomena. This change take place due to the presence of sun which is not seen in absence of sun. Theses phenomena play an important role to resultant acceleration towards the gravity which causes the change in acceleration of cluster that means decrease in acceleration of cluster.

a. Absorption Phenomena in Cluster: In this phenomena sun is present and the cluster of rain drop absorbed energy from surrounding (specific heat capacity), then the change in volume of cluster take place (expand) i.e. the molecules of water trying to goes from liquid state to gases state or transition phases. This is only possible when water molecules in cluster are going to apart from each other and means density of cluster going to be decrease and volume increase. Since volume of sphere is directly related to cube radius cluster, which implies increase radius of cluster. Therefore the sphere volume and surface area, in presence of sun is change and become given by

$$Volume(V_{PS}) = \frac{4\pi r_{PS}^3}{3} \text{…….(9)}$$

$$Area(A_{PS}) = 4\pi r_{PS}^2 \text{……...(10)}$$

Here r_{PS}= radius of cluster in presence of sun, having same mass cluster as in absence of sun.
V_{PS}= volume of cluster in presence of sun, having same mass cluster as in absence of sun.
A_{PS}= Area of cluster in presence of sun, having same mass cluster as in absence of sun.
Now, Similarly as the **case I,** we can calculate, a_{NDA}=acceleration due to gravity acting downward when cluster radius expand by absorption of light is given with the help of (6), and on putting value from (9) and (10) we get,

$$a_{NDA} = g - \frac{4\pi r_{PS}^2 v_{PS}^2 \rho_{air} C_{air}}{2 \times \frac{4\pi r_{PS}^3 \rho_{PS}}{3}} \text{ ……...(11)}$$

Here V_{PS} is velocity of rain drop cluster in presence of sun through air density ρ_{air}.

$$a_{NDA} = g - \frac{3 v_{PS}^2 \rho_{air} C_{air}}{2 r_{PS} \rho_{PS}}$$

$$a_{NDA} = g - \frac{\beta v_{PS}^2}{r_{PS} \rho_{PS}} \text{……..(12).}$$

This is the net or resultant acceleration of cluster in presence of sun, towards the gravity in absorption phenomena in cluster in term of density and radius.

b. Transmission Phenomena in Cluster: When light incidence on the water molecules or cluster of rain drop. Incidence light may transmitted through it, but due to incidence light (radiation pressure) slightly change take place in structure of the cluster due to radiation pressure. These radiation pressure causes the change in acceleration of the cluster that means the cluster accelerated towards the gravity. Now, the force due to radiation on cluster of water molecules or rain drop cluster are given by

$$Force(F_{RC}) = \frac{P_R}{A_{PS}} \text{……..(13)}$$

Where, P_R = Pressure on cluster due to presence of sun.
A_{PS}= Surface area of cluster in presence of sun.
Let cluster is accelerated with a_R downward whose mass is same M(mass of rain drop cluster is same as absence of sun). Then, the force to which this cluster move downward or accelerated down wardsdue to radiation is

$$Force(F_{DR}) = M\, a_R \text{…….(14)}$$

Since F_{RC} cause F_{DR} then equation (13) and (14) are equal therefore (causes and effect), from (13) and (14) we get

$$F_{DR}=F_{RC}$$

$$Ma_R=\frac{P_R}{A_{PS}}$$

$$a_R=\frac{P_R}{M\,A_{PS}}$$

$$a_R=\frac{P_R}{M\,A_{PS}}$$

$$a_R=\frac{P_R}{\rho_{PS}V_{PS}A_{PS}} \text{……..(15) (Since ρ=M/V)}$$

Putting the value of (9) and (10) in (15) we get

$$a_R=\frac{P_R}{\rho_{PS}.\frac{4\pi r_{PS}^3}{3}.4\pi r_{PS}^2} \text{……..(16)}$$

$$a_R=\frac{3P_R}{16\pi^2\rho_{PS}.r_{PS}^5}$$

$$a_R=\frac{\gamma P_R}{\rho_{PS}r_{PS}^5} \text{……...(17)}$$

This is the equation of acceleration to which cluster accelerated towards the gravity in the presence of sun.

where $\gamma=\frac{3}{16\pi^2}$

c. Scattering of Light: When light incidence on the cluster of water molecules or rain drop, scattering take place between the incidence light and impurities contained in cluster (here impurities are the particles contain in the cluster as shown in figure 1 and figure 2). During the scattering of the light certain amount of energy was absorbed by the particles and particles goes on the internal vibration with in the cluster whose effect is resisting the velocity of cluster. Because internal vibration of the particles decrease the velocity of cluster then that of absence of sun.

Let E is energy loss of the light after scattered from particles of the cluster then with the help of this energy the cluster vibrated for certain time t. This type of vibraction is also called a type of damping oscillation then the damping force can be expressed as

$$F_d=c\frac{dx}{dt} \text{……..(18)}$$

where, c is damping coefficient of a medium. This damping force is zero when oscillation of cluster is stop. Since this damping force is for a cluster whose mass is M and oscillated with acceleration a_d then resisting force of cluster is

$$F_d=M\,a_d \text{…….(19)}$$

Now from (17) and (18) we get

$$M\,a_d=c\frac{dx}{dt}$$

$$a_d=\frac{c}{M}\frac{dx}{dt} \text{……...(20)}$$

$$a_d=\frac{c}{\frac{4\pi r_{PS}^3\rho_{PS}}{3}}\frac{dx}{dt} \text{……...(21) [ρ=M/V]}$$

$$a_d=\frac{3c}{4\pi r_{PS}^3\rho_{PS}}\frac{dx}{dt}$$

$$a_d=\frac{\alpha}{r_{PS}^3\rho_{PS}}\frac{dx}{dt} \text{……...(22) [From equation (9)]}$$

This is the acceleration of the cluster when cluster oscillated with certain addition energy in presence of sun.

where $\alpha = \frac{3c}{4\pi}$

$$a_d = \frac{\alpha v_O}{r_{PS}^3 \rho_{PS}} \text{.....(23) [v=dx/dt]}$$

where v_o= velocity of oscillation of the cluster.

This is the damping acceleration of cluster which resist the cluster from natural falling toward the gravity.

Now, The net acceleration of cluster falling downward in presence of sun given by

$$a_{PSD} = a_{NDA} + a_R - a_d \text{.....(24)}$$

Here a_{NDA} is towards the gravity, a_R is towards the gravity, a_D is opposite of gravity.

On putting the value from (12), (17), (23) in (24) we get

$$a_{PSD} = g - \frac{\beta v_{PS}^2}{r_{PS}\rho_{PS}} + \frac{\gamma P_R}{\rho_{PS} r_{PS}^5} - \frac{\alpha v_O}{r_{PS}^3 \rho_{PS}} \text{.....(25)}$$

This is the net acceleration acting downward in the presence of sun. Since P_R is very small and r is increase then the ration is negligible or tends to zero then equation (25) become

$$a_{PSD} = g - \frac{\beta v_{PS}^2}{r_{PS}\rho_{PS}} - \frac{\alpha v_O}{r_{PS}^3 \rho_{PS}} \text{.....(26)}$$

Dividing (26) by (7) we get,

$$\frac{a_{PSD}}{a_{ND}} = \frac{g - \frac{\beta v_{PS}^2}{r_{PS}\rho_{PS}} - \frac{\alpha v_O}{r_{PS}^3 \rho_{PS}}}{g - \frac{\beta v_{AS}^2}{\rho_{AS} r}} \ll 1$$

$$\frac{a_{PSD}}{a_{ND}} \ll 1$$

$$a_{PSD} \ll a_{ND} \text{.....(26)}$$

This show the net acceleration of cluster towards the gravity in presence of sun is less than the net acceleration of cluster towards the gravity in absence of sun. This is due to absorption, transmission and scattering of light by rain drop cluster.

Hence, force carried by cluster in absence of sun is also greater than presence of sun. Therefore, when cluster hit us in absence of sun we get hurt more than presence of sun.

IV. Result and Discussion

We have developed numbers of equation in **Case I** and **Case II** related to retardation and acceleration in absence and presence of sun. And finally find, the net acceleration toward the gravity in absence of sun is grater than presence of sun (have consider same mass of rain drop of cluster in both cases). Since we have consider the same mass in both **Case I** and **Case II**, and we have F=ma therefore for constant mass, F is directly proportional to net acceleration towards the gravity, then from equation (26), the force carried by cluster in presence of sun is less then in absence of sun and when the cluster hit us we get more hurt in absence of sun than in presence of sun. We can also say that the rain drop cluster in night time carried more force then the day rain drop cluster.

V. Conclusion

Hence, from above mathematical relation we can conclude that the force carried by cluster in presence of sun less than that of absence for same mass of cluster and consideration assumption. Therefore, we can give advice to the people to save their thing which is very soft in open environment like agriculture plants, medicinal plants, herbs and shurbes in rainy time in absence and presence of sun.

References

[1]. Stillinger FH, Davida CW. Polarization Model for Water and Its Ionic Dissociation Products. Journal of Chemical Physics. 1978;69(4):1473-1475.

[2]. Weingartner JC,Draine BT.Forces on Dust Grains Exposed to Anisotropic Interstellar Radiation Fields. The Astrophysical Journal. 2001;553:581-582.

[3]. Coulson CA, Eisenberg D. Interactions of H_2O Molecules in Ice and Interaction Energies of H_2O Molecules in Ice. Proceeding of The Royal Society A. 1966;291:454-459.

[4]. Badyal YS, Saboungi ML, Price DL, et al. Electron Distribution in Water. Journal of Chemical Physics. 2000;112:9206–9208.

[5]. Brookes DH, Head-Gordon T. Family of Oxygen–Oxygen Radial Distribution Functions for Water. Journal of Physical Chemistry Letter. 2015;6:2938–2943.
[6]. Clough SA, Beers Y, Klein GP, et al. Dipole Moment of Water from Stark Measurements of H_2O, HDO, and D_2O. Journal of Chemical Physics. 1973;59:2554–2559.
[7]. Arias-Esparza MDC, Arias RIS, Arias PES, et al. The Unexpected Capability of Melanin to Split the Water Molecule and the Alzheimer's Disease. Neuroscience & Medicine. 2011;2:217.
[8]. Batista ER, Ayotte P, Bilic A, et al. What Determines The Sticking Probability of Water Molecules on Ice?. Physical Review Letters. 2005;95:1-4.
[9]. Moore FG, Richmond GL. Integration or Segregation: How Do Molecules Behave at Oil/Water Interfaces?. Accounts Of Chemical Research. 2008;Xxx(Xx):b-c.
[10]. McDonald KT. Radiation Pressure of a Monochromatic Plane Wave on a Flat Mirror. 2009:4
[11]. Fontaine P, Goldmann M, Bordessoule M, et al.Fast and Adjustable Resolution Grazing Incidence X-Ray Liquid Surfaces Diffraction Achieved Through 2d Detector.:4.
[12]. Fournier MJG. Light Scattering by Particles in Water. Theoretical and Experimental Foundations. 2007:1st Edition. (Academic Press).
[13]. Poissier A. Theoretical Characterization of Water/Surfaces Interactions. 2011:9-10. (Stony Brook University:PhD Thesis).
[14]. Rezus YLA, Bakker HJ. Effect of Urea on the Structural Dynamics of Water. Proceedings of the National Academy of Sciences. 2006;103(49):18417.
[15]. Downing J. Light Absorption & Scattering in Water Samples. 2008:1-2. (Campbell Scientific, Inc.).
[16]. Elles CG, Shkrob IA, Crowell RA, et al.Excited State Dynamics of Liquid Water: Insight from the Dissociation Reaction Following Two-Photon Excitation. :2-3.
[17]. Andereck BS. Measurement of Air Resistance on an Air Track. American Journal of Physics.1999;67(6):531.

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