PHYSICS ESSAYS **32**, 2 (2019)

Antigravity, a major phenomenon in nature yet to be recognized

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(Received 12 January 2019; accepted 20 February 2019; published online 11 March 2019)

Abstract: The general belief is that the gravitational force is always attractive and no repulsive force could result. This is contrary to properties of electric and magnetic forces. These two forces can cause in both attraction and repulsion, depending on the situation. However, the investigation set forth here on the movement of liquid water droplets in still air prompts us to believe of a hidden force, a force against the gravitational pull hitherto unknown to the world of science. It is felt, as shown by the reasoning adduced herein, that the upward movement of the water droplets cannot be explained by the conventional principles of physics known to us; hence, the need of the antigravity hypothesis. © *2019 Physics Essays Publication*. [http://dx.doi.org/10.4006/0836-1398-32.2.141]

Résumé: La croyance générale est que la force gravitationnelle est toujours attirante et une force repoussante ne peut en résulter. Ceci est contraire aux propriétés des forces électriques et magnétiques. Ces deux forces peuvent entraîner à la fois une force d'attraction et une force de répulsion, selon la situation. Cependant, l'enquête présentée ici sur le mouvement des gouttelettes d'eau liquide dans l'air immobile nous incite à penser à une force cachée, une force contre l'attraction gravitationnelle jusqu'ici inconnue du monde scientifique. Comme le montre le raisonnement présenté ici, on pense que le mouvement ascendant des gouttelettes d'eau ne peut être expliqué par les principes classiques de la physique que nous connaissons. D'où la nécessité de l'hypothèse de antigravité.

Key words: Gravitational Force; Internal Energy; Force against Gravitation; Antigravity.

I. INTRODUCTION

Gravity is a one of the fundamental forces identified in nature, formulated by Sir Isaac Newton in 1728 as: The law of universal gravitation.[1] Herein the gravitational force was interpreted as an attraction force as against the field described by Laplace.[2,3] In quantum mechanics, the mediating force between physical bodies is brought about by the hypothetical particle—graviton.[4]

However, in contrast to the electromagnetic forces which are dual in nature—like positive and negative electric fields, north and south magnetic poles, gravitational field is unique in that no such duality has been shown to exist, so far. Even in fundamental weak and strong interactions, the above dual property has not been established.

General relativity[5] does not specifically recognize a repulsive gravity force or so called "antigravity" as a concept. However, from the inception, scientists have been searching for negative mass[6,7] which could lead to antigravity.

Since of late, several efforts have been underway in probing potential situations of antigravity type effects.[8,9] It is worthwhile to discuss in brief an important observation/result obtained from one of authors' antigravity related experiment. In this experiment,[8] upward mobility of iodine molecules (126.9 amu) in vacuum has been studied. In this study, solid iodine molecules which undergo a change of state/phase transition to gaseous form by acquiring latent heat in vacuum have shown a movement against the gravitational field. In the same study, the upward movement (movement against the gravitational pull) of very heavy metallic substances, e.g., Tungsten/Thorium, (183.84/232.04 amu, respectively) in vacuum has also been shown. The figure extracted from Ref. 8 demonstrating the upward movement of iodine in vacuum is shown in Fig. 1. The complete description can be found in Appendix A.

Several different attempts have been made to rationalize/interpret the cause of gravity.[5,10,13] No such attempts have been made, so far, in regard to antigravity.

The object of this paper is not an interpretation of antigravity but to demonstrate experimental evidence with some information about a force against the conventional gravitational force which is shown to increase with the temperature—the internal energy of a water-droplet under observation.

Expt. 1 follows a qualitative approach where the tendency of water droplets to rise is directly observed. Further, this observation has been theoretically discussed in detail elsewhere in this manuscript. In the discussion, all scientific theories/equations available relevant to the discussion have been quoted.

Expt. 1 reported in this manuscript was designed in order to investigate the rising of water droplets in a situation, where known surrounding physical conditions are

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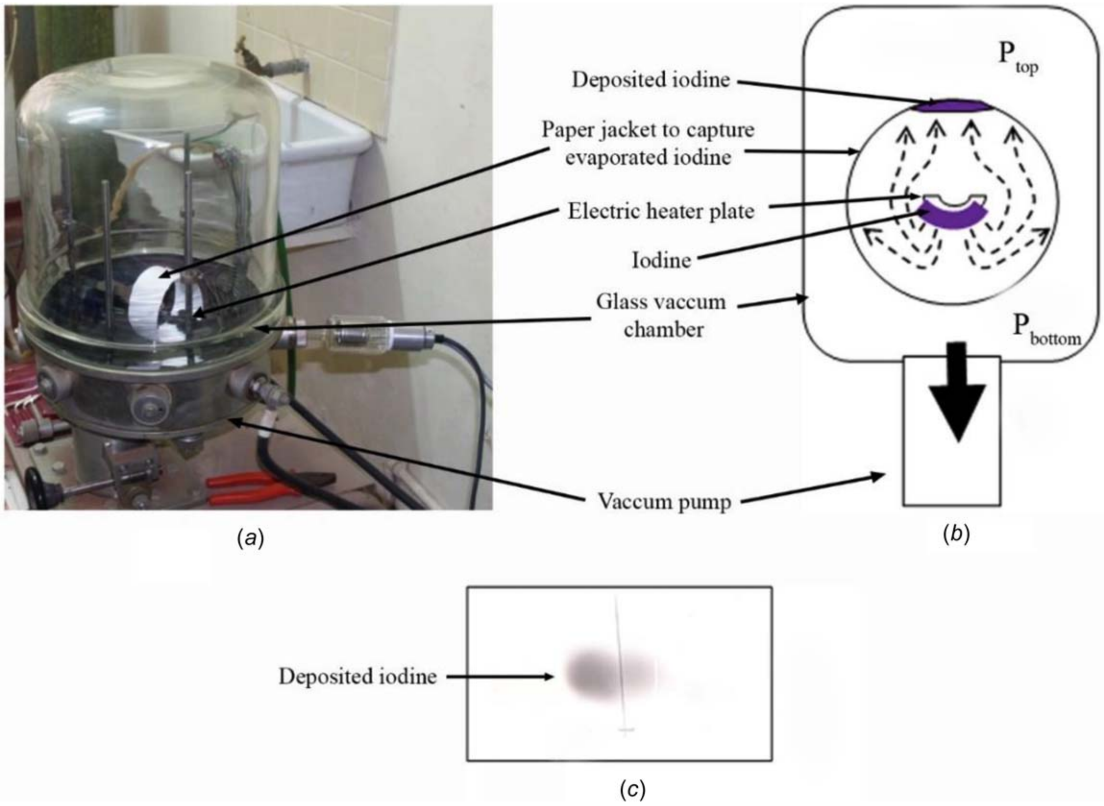

FIG. 1. (Color online) Figure extracted from Ref. 8—Experimental setup to observe movement of heat-evaporated iodine vapor in vacuum. (a) Vacuum deposition chamber; (b) a layer of iodine was slowly heat evaporated (ejected downward direction) inside the vacuum chamber. The electrical heater plate itself covers the iodine emission directly to the upward direction. The iodine source was surrounded with a paper jacket in order to capture the deposition geometry of iodine. The paper was placed 50 mm radially away from the iodine source. Pressure in the chamber was $\sim 1 \times 10^{-5}$ mbar, average mean free path is greater than 6.6 m and air density is approximately 12.6 ng m^{-3}. Pressure at the top (P_{top}) of the chamber is higher than the bottom (P_{bottom}), $P_{top} > P_{bottom}$. (c) Photograph of deposited iodine on inner top part of the paper. Reprinted with permission from C. K. G. Piyadasa, Can. J. Pure Appl. Sci. **5**(2), 1586 (2011).

unfavorable to its direction of motion, excluding the factors which are generally believed to be the main reason for the upward movement of particles: the convection lift. In considering the equilibrium of the rising and falling water-droplet in still air, attention has been given to all relevant factors—force of gravity, buoyancy, surface evaporation,[14,15] and force due to the temperature profile in air.[16,17] A similar study[9] has been done by the author and it shows that the higher density water droplets (relative to the surrounding air) move against the earth's gravitational pull and it could be concluded that the internal energy (latent/specific heat) may be related to the upward mobility in the water droplets in the absence of conditions for surrounding air convection (discussion in Sec. IV A).

Relevant forces in the water-droplet in still air are shown in Fig. 2. Mass of the water-droplet is m. The temperature and the density of air, below and above of the water-droplet are t_1, t_2 and ρ_1, ρ_2. mg, F_b, and F_{vs} are forces acting on the water-droplet in air due to its mass, volume, and gravity, g.

In experiment 1, the experimental conditions are set as the temperature (t_1) of air, below the water-droplet is lesser than above (t_2). Therefore, no convection current is possible (as t_1 is less than t_2). However, because of the difference in temperature ($\Delta t = t_2 + t_1$), the density ρ_1 in air below the water-droplet is greater than the density ρ_2. Difference in density causes a pressure difference and this force F_u[16,17] acts on the water-droplet.

For the equilibrium of a water-droplet in still air with vertical temperature difference as shown in Fig. 2(a) is given in Eq. (1)

$$mg \downarrow = F_b \uparrow + F_u \uparrow . \tag{1}$$

A new quantity, F_{ratio} is defined as

$$F_{ratio} = \frac{\text{Total downward force} \downarrow}{\text{Total apperent upward force} \uparrow} = \frac{mg \downarrow}{[F_b + F_u] \uparrow}. \tag{2}$$

The rationality of the F_{ratio}: The F_{ratio} considered here is a useful approach to see how the total downward force compares with the total upward force of the water droplet. At the equilibrium, the value for the F_{ratio} could be nearly 1.

For downward movement of water droplet; $F_{ratio} > 1$, $F_{vs} \uparrow$ acts upward.

For upward movement of water droplet; $F_{ratio} < 1$, $F_{vs} \downarrow$ acts downward.

The average diameter of a water-droplet due to condensed steam at room temperature of 30 °C and relative humidity around 70% is 10 μm.[9] The F_{ratio} was calculated

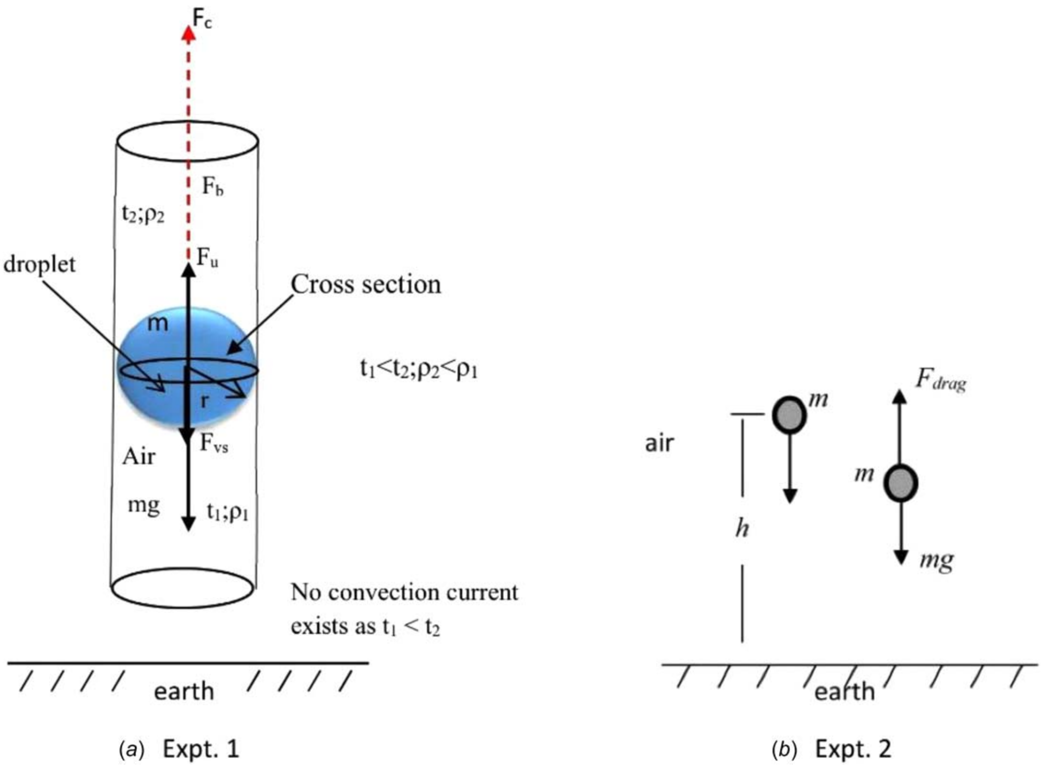

FIG. 2. (Color online) (a) Experiment 1; Forces acting on a water droplet suspended in column of still air. The temperature and the density of air, below and above the water-droplet are t_1, t_2 and ρ_1, ρ_2. Forces acting on the water-droplet are weight ($mg \downarrow$), buoyancy ($F_b \uparrow$) and force due to temperature difference of air ($F_u \uparrow$). The viscosity force acting on upward moving water-droplet is $F_{vs} \downarrow$. The unrecognized cryptic force is denoted as $F_c \uparrow$. $F_{vs} \downarrow$ and $F_c \uparrow$ will be discussed in the section of "Interpretation of Results." (b) Experiment 2; Forces acting on sphere under free-fall in still air are $F_c \uparrow$ and $F_{\text{drag}} \uparrow$.

for Δt and r[18,b)] (Fig. 3) by substituting the average diameter of the droplet using Eq. (2). Δt (°C) is the difference in temperature ($t_2 - t_1$) across the cross section of droplet and r is the radius of the droplet [Fig. 2(a)]. The calculation shows that the F_{ratio} is independent of r [Fig. 3(a)] but varies with Δt [Fig. 3(b)].

The plot of F_{ratio} against Δt tells us that the downward force is higher for the smaller Δt. However, even for higherΔt, for example, Δt of 50 °C, the F_{ratio} is around 700. That is; the downward force is nearly 700 times greater than the upward force.

Shape of a water droplet is assumed to be spherical due to surface tension if there is no relative motion in still air. The shape of the water droplet is affected by the magnitude of its velocity[19] if there exists relative motion between air and the droplet. A common misconception is the shape of the raindrop which often depicted as pointy and lopsided. However, research has found the shape of a raindrop to be rather spherical[19] or slightly flattened on the bottom by airflow like a hamburger bun. The eccentricity (deviation of the spherical shape) of the water droplets used in Expt. 2 (around 1 mm in radius) at low velocities (below 5 m/s) is nearly zero (see calculations given in Table 1 of Ref. 19) and can be considered as spherical. Therefore, it is possible to use rigid body approximation for calculation in this paper.

A spherical water droplet under free-fall in air has also been considered (Expt. 2) [Fig. 2(b)] and the relevant theoretical principles[20,c)] are shown below.

At terminal velocity, v_t

$$F_{\text{drag}} = mg. \tag{3}$$

The characteristic time, τ

$$\tau = \frac{v_t}{g}, \tag{4}$$

where v_t, terminal velocity is given by $v_t = \sqrt{\frac{2\,\text{mg}}{C\rho_a A}}$, m is mass, g is gravity, A is the cross sectional area, ρ_a is the density of air where object is falling. C is the drag coefficient and the approximate value is 0.5 for a sphere.

Evaporation occurs from the surface of a liquid droplet (sphere). The surface evaporation depends on temperature and the speed of the water droplet, temperature and humidity of air. Amount of evaporated water content, g_s per second can be expressed as[d)]

$$g_s = \frac{\Theta A(x_s - x)}{3600}. \tag{5}$$

$\Theta = (25 + 19v) =$ evaporation coefficient (kg/m^2 h); $v =$ relative velocity of air above the water surface (m/s);

b)https://www.engineeringtoolbox.com/evaporation-water-surface-d_690.html

c)https://en.wikipedia.org/wiki/Terminal_velocity

d)https://www.engineeringtoolbox.com/natural-draught-ventilation-d_122.html

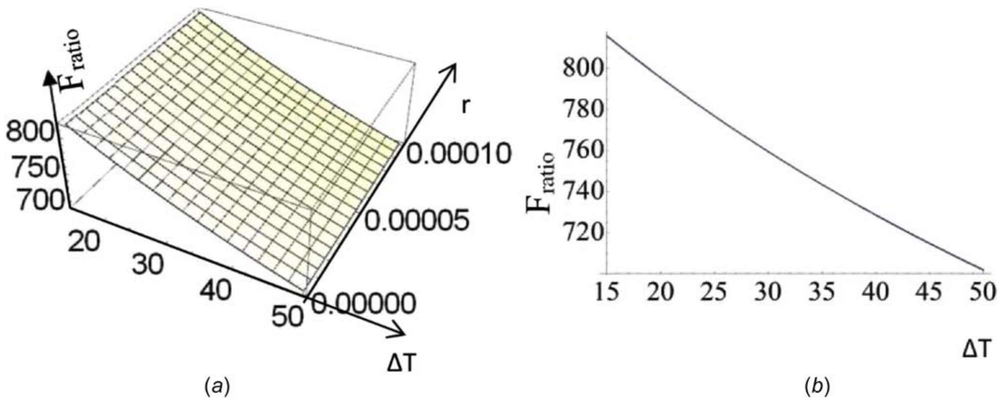

FIG. 3. (Color online) (a) Change of F_{ratio} according to temperature difference, r (°C) and the radius of water droplet, r (m). (b) Change of F_{ratio} according to temperature difference, ΔT (°C).

A = water surface area (m^2); x_s = maximum humidity ratio of saturated air at the same temperature as the water surface ($kg_{H_2O}/kg_{\text{Dry Air}}$); and x = humidity ratio of air ($kg_{H_2O}/kg_{\text{Dry Air}}$).

Second experiment was carried out to ascertain whether heavier water-droplets (order milligram) influence the time-of-flight with temperature similar to the droplets considered in Expt. 1 (order sub microgram).

II. METHOD

A. Experimental sequence

1. Experiment 1

Steam was sent via a water condenser and ejected inside an ice cylinder, downward as in Fig. 4(a). The steam becomes water droplets when it passes through the copper tube due to its cooling effect. The stream of water droplets (at temperature 80–90 °C were set by the water condenser) moves downward inside an ice cylinder due to its kinetic energy as in Fig. 4(a).

The temperatures were measured simultaneously at several heights ($Z_1 = 0$ cm, $Z_2 = 5$ cm, $Z_3 = 10$ cm, $Z_4 = 15$ cm) inside the icy-cylinder as in Fig. 4(a) when the system is in thermal equilibrium. Observe the path of the water-droplets in its trajectory inside the ice-cylinder. Repeat the experiment with steam flow of different rate.

2. Experiment 2

a. Investigating the time-of-fall (t_f) of water-droplet under varying droplet temperature In the second experiment, a water-droplet with mass 4 mg at a temperature of 10 °C was dropped through a metal tube of height 5.913 m [see

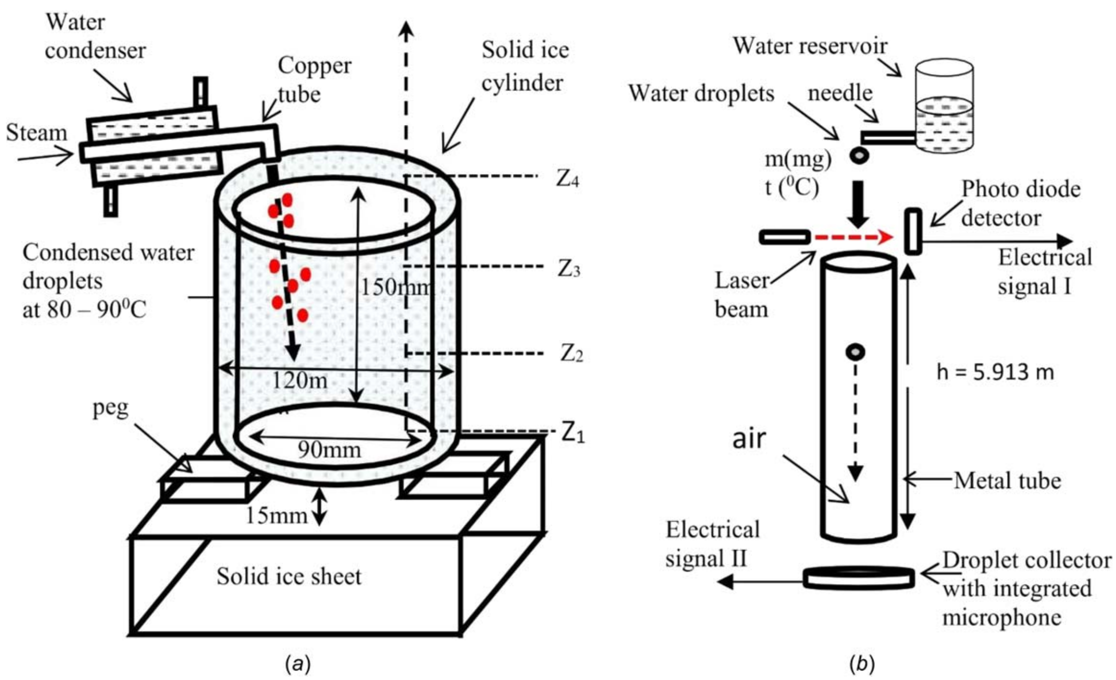

FIG. 4. (Color online) (a) Experiment 1; Condensed water droplets are ejected downward inside an ice cylinder. (b) Expt. 2; Water droplets of mass 4 and 9 mg with temperatures of 10, 30, and 60 °C were sent through the metal tube of 5.913 m. Time-of-fall of each water droplet through the metal tube was measured by electrical signals generated at the two ends of the metal tube. Twenty five readings were averaged.

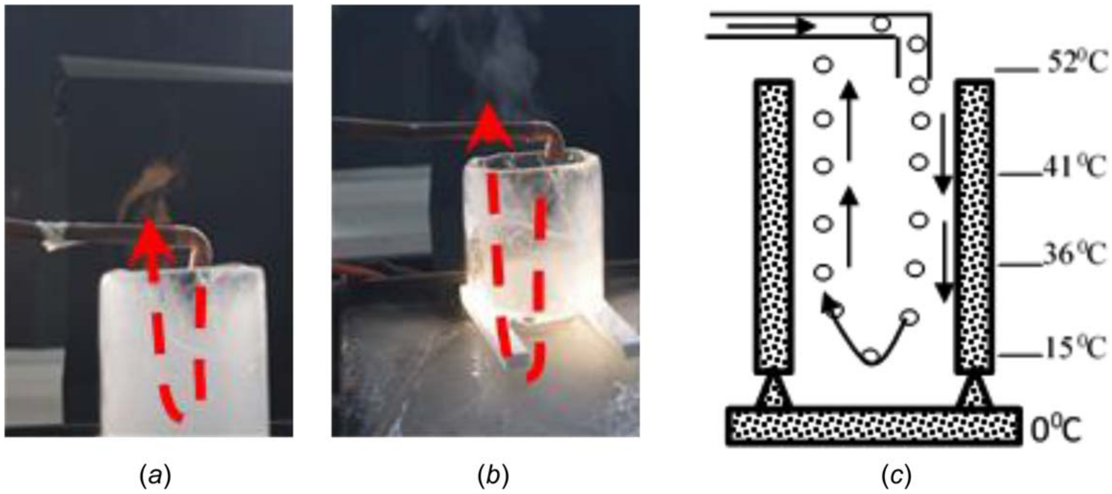

FIG. 5. (Color online) Two different flows of water droplets [5(a) and 5(b)] show similar upward movement of water droplets. (c) shows the temperature distribution inside the ice cylinder and the graphical view of the movement of condensed water droplets.

Fig. 4(b)] and the time-of-fall (t_f) measured. The experiment was repeated for the droplet at temperature 30 °C and 60 °C.

Dropped another water-droplet of different mass of 9 mg and repeated the above reading. 25 readings were averaged for each measurement of droplet.

The droplet size was determined by the bore size of the needle of droplet generator. The initial velocity (hence the initial kinetic energy) of the droplet at the needle mouth is zero as the needle was placed horizontally and water is let fall freely under gravitational force (gravity feed) through a needle which is connected to a small reservoir as in Fig. 4(b). The height of the water column in the small reservoir was maintained constant throughout the experiment.

The time of fall of the droplet was measured by time difference of two electrical signals (electrical signals I and II) that are obtained when the droplet enters the metal tube and when the droplet touches the collector at the end. Signal I is generated at the photo diode when the droplet intercepts the laser light beam. Signal II is generated by a microphone connected to the droplet collector which is constructed by a thin metal film. Signals I and II are fed to two channels of an oscilloscope in order to get the time difference and hence the time of fall.

The relative humidity was around 70% at 30 °C in the experimental site.

III. OBSERVATIONS AND MEASUREMENTS

Figures 5(a) and 5(b) show the path of condensed water droplets inside the ice cylinder for two different water-droplet flows. Droplets ejected from the end of the copper tube move downward inside the ice cylinder due to the initial kinetic energy. The temperature profile inside the ice cylinder is shown in Fig. 5(c). The temperature at the bottom of the ice cylinder was 15 °C and gradually increased with the height. The temperatures were 36, 41, and 52 °C at heights 5, 10, and 15 cm, respectively. Once the droplets reach close to the bottom due to the direction of their initial kinetic energy, droplets turn around and move upward in a positive temperature gradient where no air convection occurs. There is ample space in between ice sheet and the cylinder at bottom [pegs in Fig. 4(a)] if droplets need to rest/leave at the bottom.

Table I shows parameters of water droplets of 4 and 9 mg, respectively.

Temperature, density, radius, cross-sectional area, and percentage increase in cross-sectional area relative to the droplet at 10 °C, t_f inside the tube of 5.913 m and percentage increase in t_f relative to the t_f of the droplet at 10 °C, where Δt_f is the increase in time-of-fall.

Table I clearly shows that the t_f of droplets of weight 4 and 9 mg (in still air) increases with the increase in temperature of the droplets.

The graphical representation of the t_f (ms) of two water droplets in Fig. 6 shows nearly linear variation with the increase in temperature (in water droplets). Correlation between two curves is 0.99992.

IV. INTERPRETATIONS OF EXPERIMENTAL OBSERVATIONS FROM CONVENTIONAL THEORY

The manuscript developed herein is based on two experimental procedures (Expt. 1 and Expt. 2) describe here. The

TABLE I. Time of fall (t_f) of water droplets of 4 and 9 mg in air at temperatures 10, 30, and 60 °C.

		Radius (mm)		Cross-sectional area (mm^2)		Sur. area (mm^2)		t_f (ms)		Δt_c (ms)	
Temp (°C)	Density (g/cm)	4 mg	9 mg	4 mg	9 mg	4 mg	9 mg	4 mg	9 mg	4 mg	9 mg
10	0.9997	0.985	1.291	3.0481	5.2360	12.19	20.93	1278	1202		
30	0.9956	0.986	1.292	3.0542	5.2442	12.22	20.99	1294	1220	16	18
60	0.9832	0.990	1.298	3.0791	5.2930	12.32	21.16	1322	1250	28	30

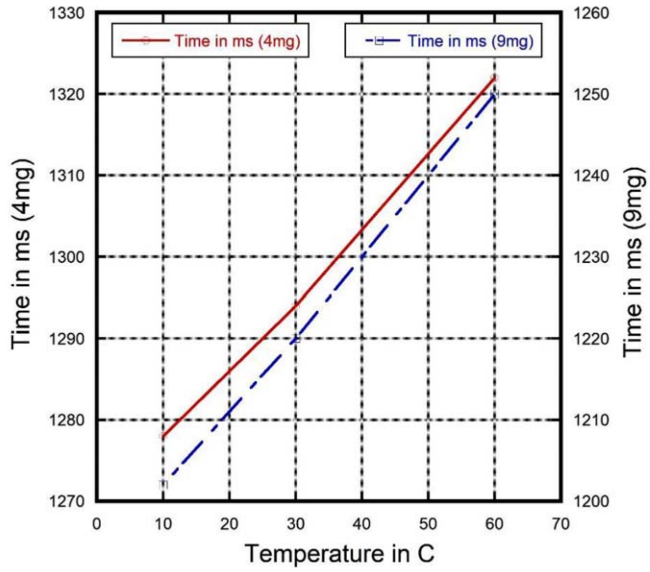

FIG. 6. (Color online) Graphical representation of t_f (in Table I) through a metal tube of water droplets of masses 4 and 9 mg against temperature t (°C).

basis of our interpretation rests on the following experimental validation.

Water-droplets (of the order 10–20 μm in diameter[9]) tend to rise against gravity in a manner yet unaccounted for. Other particles such as iodine molecules (though much denser than water) too have shown this behavior.[8]

Water-droplets (of the order 4 mg/9 mg mass) tend to fall slower with the increase of temperature in still air.

A. Experiment 1

The jet of water-droplets entering the ice-cylinder, stream down, curve upward and rises have been observed. Initial downward stream is due to the pressure of steam sent in (kinetic energy of steam) and gravitational pull. Later these droplets dissipate their kinetic energy and curve upward.

The experimental setup was designed in such a way that the upward mobility of the water droplets is not supported by the convection currents which is the major concern for upward motion of particles in air/atmosphere. There is no primary thermal source below the turnaround point (TAP) of water droplets and only the radiation from the hot water droplet and water vapor emanating from the tube can cause temporary heating to activate convection. This is further confirmed by Fig. 7 extracted from Ref. 9, the thermal image of downward projected condensed steam droplets (CSDs) taken at room temperature (24 °C) from the Cryogenically cooled third generation forward looking infrared (FLIR) thermal camera (3–5 μm), see Fig. 7.

Thermal image reveals that there is no significant increase in temperature measured below the turning point (Fig. 7) by the radiation of heated water droplets moving above. Instead a decreasing temperature gradient [Fig. 7(c)] is found. This does not support the upward movement of liquid or gas by the current knowledge of convection. Figure 7(a) shows the thermal image of the TAP of CSD. The temperature intensities are converted into a color gradient and presented in Fig. 7(b) for better visualization of the temperature distribution at the TAP. The lower part, from UV to XY shows [Fig. 7(c)] decreasing temperature from 60 °C to 24 °C (RT) which definitely inhibits any possible upward convection movement.

In the present Expt. 1, the temperature at TAP, inside the ice cylinder, is close to 15 °C which is much lower compared to the experiment conducted at 24 °C, shown in Fig. 7. Therefore, it has a wider temperature difference at TAP with absolutely no convection currents.

Second, the average dimensions of the water droplets must suffice to a condition if they are affected by the pressure exerted by the air molecules, as the pressure is a continuum property. In practice, the average dimension (d) of the area affected by the pressure has to be larger than at least ten times the square of the mean free path (λ)[21,e)] of air molecule (i.e., $d > 10 \times \lambda^2$).

In the case of convection current, the upward thrust acts on horizontal cross-section of the water droplets by air molecules.

The average dimension (diameter in the case of water droplet) of a water-droplet due to condensed steam at room temperature of 30 °C and relative humidity around 70% is around 10 μm.[9] The mean free path of the air at atmospheric pressure is approximately 65 nm.[22] So, the minimum average length of the area required to be affected by the pressure is nearly equal to 42.3 μm. However, the water droplets that we consider in this experiment are around 10 μm in diameter which are much smaller than the minimum area that should prevail to be affected by the pressure due to molecular motion of air convection. Therefore, the air convection is not affecting the water droplets even if there exists a small convection current.

Third, Water droplets of 10 μm diameter are approximately 1.1×10^{13} times heavier than the air molecule. According to the classical mechanics, in this elastic collision, only a minute kinetic energy is transferred to the water droplet. (Calculation in Appendix B shows that there is hardly any energy/momentum transferred.)

It is clear that from above three arguments;

1 No convection currents occur at TAP,
2 Cross-sectional areas of the water molecules are not sufficient to experience a pressure force from air molecules due to mean free path.
3 Momentum transfer between water droplets and air molecules shows that there is hardly any energy/momentum transferred.

Therefore, it can be concluded that there is no effect from convection current on water droplets at TAP. The only forces acting on water droplets at TAP are buoyancy (F_b) and the force due to the pressure difference (F_u).

[e)]http://www.efluids.com/efluids/bicycle/bicycle_pages/pressure.jsp

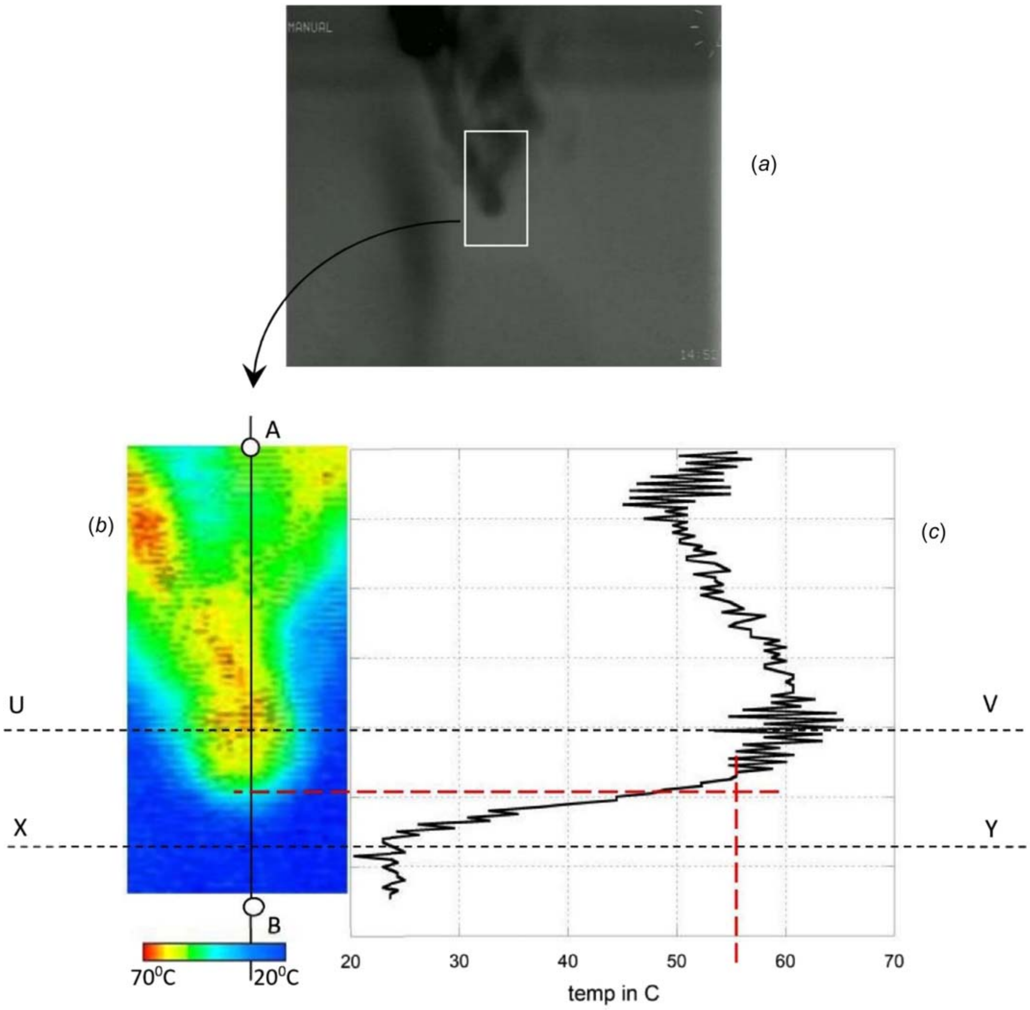

FIG. 7. (Color online) Figure extracted from Ref. 9—Thermal image of the TAP of the stream of the CSDs and the vertical temperature distribution of the middle of TAP area. (a) Thermal image of downward projected CSD taken from the Cryogenically cooled third generation FLIR thermal camera (3–5 μm). (b) Temperature distribution at the droplet turning around area. Color gradient is proportional to the temperature as shown in the plate below. (c) Temperature distribution along the line AB in (b). Reprinted with permission from C. K. G. Piyadasa, Can. J. Pure Appl. Sci. **6**, 1995 (2011). Copyright 2011 SENRA Academic Publishers.

By substituting values for water droplets of 10 μm (Ref. 9) in Eq. (1), following results are obtained. Δt was taken as 50 °C.

$$mg\downarrow = F_b\uparrow + F_u\uparrow \tag{1}$$

$$mg\downarrow = 4100\times 10^{-14}\,\mathrm{N} \tag{1a}$$

$$\begin{aligned} F_b\uparrow + F_u\uparrow &= 5.0\times 10^{-14} + 1.1\times 10^{-14} \\ &= 6.1\times 10^{-14}\,N\uparrow \\ mg\downarrow - (F_b\uparrow + F_u\uparrow) &= 4093.9\times 10^{-14}\,N\downarrow \\ &\quad (\text{i.e. } F_{\mathrm{ratio}} = 672) \end{aligned} \tag{1b}$$

In this situation ($F_{\mathrm{ratio}} = 672$), water-droplet in still air can never be expected to rise, but gather at the bottom of the air-column (here, at the bottom of the ice-cylinder as liquid water).

However, it is observed that in such a condition, the water-droplets move upward. For this upward movement to happen, a large additional force has to be accounted for on the right-hand side of Eq. (1).

Viscous drag force $F_{vs}\uparrow$ (arising due to the viscosity of air) being downward [Fig. 2(a)] has no effect on the argument.

The additional force is acting as cryptic upward force, $F_c\uparrow$, which is still unrecognized. So the new equation appears as Eq. (6)

$$mg\downarrow = F_b\uparrow + F_u\uparrow + F_c\uparrow\,. \tag{6}$$

B. Experiment 2

The calculated terminal velocity (v_t) and the characteristic time [τ; Eq. (4)] for each droplet also show no remarkable difference in t_f at temperatures used. For example; terminal velocities of 4 mg droplet are 6.317, 6.321, and 6.333 m/s in still air at 10, 30, and 60 °C, respectively. This yields that 4 mg droplet take 644.6 and 646.2ms to attain its terminal velocities at 10 and 60 °C (two extreme temperatures used in this experiment). The time difference is only 1.6 ms and this time value is negligible compared to the measured value of 44 (1322 − 1278) ms.

TABLE II. Calculated change in mass (evaporation loss) of water-droplets at selected temperatures according to Eq. (5).

	Change in mass	
Temp. (°C)	4 mg	9 mg
10	+0.0043	+0.0073
30	−0.0031	−0.0054
60	−0.0502	−0.0853

+ Condensation − Evaporation.

Is reduction of mass of water-droplet due to surface evaporation affecting our argument?

For clarity of argument, the effect of mass change of falling droplet has to be considered. The mass change involved is given in Table II.

The minus (−) sign indicates that the droplets at 10 °C grow in water mass, which is similar to the growth of a rain drop,[23] according to Eq. (5). Here, the condensation is greater than the evaporation.

The following calculation provides the answer.

$$\text{Increase in time of fall } (\Delta t_f) \text{ due to } 30\,^\circ\text{C rise in } 4\,\text{mg is } 28\,\text{ms } (1322 - 1294) \tag{7}$$

t_f of 4 mg droplet at 30 °C → 1294 ms
t_f of 9 mg droplet at 30 °C → 1220 ms

$$\text{Therefore, for 5 mg mass loss} \rightarrow t_f \text{ loss 74 ms} \tag{8}$$

Calculated evaporation loss for 4 mg at 30 °C → 0.0031 mg—Table II
Calculated evaporation loss for 4 mg at 60 °C → 0.0502 mg—Table II

$$\text{Therefore, surface evaporation loss of mass in 4 mg due to } 30\,^\circ\text{C rise is 0.0471 mg} \tag{9}$$

From (8) and (9), expected fall of t_f due to evaporation due to 30 °C rise,$= \frac{74\text{ms}}{5\text{mg}} \times 0.0471\text{mg} = 0.6971\text{ms}$.

Hence, it is clear that the expected loss of t_f due to surface evaporation is very small (0.6971 ms) compared to the true value 28 ms [Eq. (7)].

Thus, the conclusion is that the terminal velocity and surface evaporation are negligible and can be ignored. This leads to the speculation of the cryptic force $F_c \uparrow$ which could be the antigravity force yet to be identified.

In experiment 1, the upward motion is difficult to explain without hypothesizing, a large hitherto unrecognized mysterious force—the cryptic force, $F_c \uparrow$.

In experiment 2, t_f (time of fall) of a water-droplet in still air increases with the temperature of the droplet. That is: "The hotter the water-droplet, the slower it falls"

It is hypothesized here that cryptic force upward increases with the temperature of the water droplet (which is also shown by author in one of his publications[9]). It is worthwhile noting that no other concept of general physics could explain both observations, rise of water-droplets (in μm scale) and the delay of fall of water-droplets (in mm scale) with the rise in temperature. Further, it has to be borne in mind that the internal energy of the water drastically increases with the temperature as water has a high specific heat capacity (4.19 kJ K^{-1}) which is higher than any other common substance.

It has to be emphasized that similar upward movements against the gravitational pull too have been shown by the author[8] in heavy solid metallic molecules (e.g., iodine and tungsten) in vacuum—which excludes possible effects of fluid dynamics. However, the vacuum situation cannot be utilized for the study regarding the movement of water droplets as they tend to vaporize in such situations.

V. CONCLUSION

The objective of this endeavor has been to establish the presence of an antigravity force yet to be identified in the realm of science. The forgoing analysis using rising and falling water-droplets in still air affords clear evidence to speculate the existence of an antigravity force. It is possible that the antigravity, the force against gravity, may not be strong enough as the gravity force normally encountered around us. This may be the reason it has been elusive so far in showing its existence. However, the duality in gravitation is not a far-fetched idea or some imagination as it might appear at first sight. For example, both positive (+) and – negative (-) electric fields and north (N) and south (S) magnetic poles of opposite character are encountered. Even for the electron (-) the positron (+) is also an alternative possibility. In this light if gravity is taken as positive (+) gravity and negative (–) gravity would amount to antigravity. Further, physicists over the years have attempted to forge a **unified theory** for all types of energy. In this context too, the antigravity concept is worthy of consideration.

ACKNOWLEDGMENTS

Experimental work was conducted at the Department of Electrical and Computer Engineering, University of Manitoba. The author was financially supported by the Natural Sciences and Engineering Research Council (NSERC) of Canada. He gratefully acknowledges the support given by the Sri Lanka National Science Foundation (Grant No. NSF/Scientist/2007/01) to initiate the project. Duplication of the experiments was conducted and supported by the Sri Lanka Institute of Nanotechnology (SLINTEC). The financial support given by Harsha Subasinghe and the Codegen International Pvt. Ltd is greatly acknowledged. The author acknowledges A. Gole and U. Annakkage for continual support of this work. The author would also like to acknowledge H. Piyadasa, G. S. Palathirathna Wirasinha, R. Weerasinghe, K. L. Haputhanthrige, and J. A. D. P. Senevirathna for their extensive edits to improve the quality of this manuscript.

APPENDIX A: HEAT EVAPORATED IODINE VAPOR IN VACUUM (METHOD AND OBSERVATIONS)

This experiment was designed in order to investigate the rising of particles that are in a similar condition as condensed steam-particles in air but having excluded all factors which were previously believed to have been the reason for the upward movement of steam droplets: viz., buoyancy and the lift force.

A layer of iodine (126.9 amu) was slowly heat-evaporated in a vacuum $\sim 10^{-5}$ mbar (chamber radius and height is 15 and 40 cm, respectively) so that the evaporated iodine should be projected downward. The weight of the iodine used for this experiment was approximately 0.8 g. Then the pattern of iodine vapor deposited on a roll of paper surrounding the iodine source was observed [Figs. 1(a) and 1(b)].

Melting time for the iodine was changed by changing the rate of change of current. Maximum current used was $\sim$70 A. Deposition pattern of iodine was taken for different rate of melting time of iodine from 1 to 10 s with 1 s intervals. Experiment was repeated for different conditions discussed in Appendix A1.

1. Observations

Though the vaporized iodine molecules were ejected downward with a certain initial kinetic energy, interestingly, it is found that the molecules have moved upward and deposited on top surface of the encircled paper [see Figs. 1(b) and 1(c)] except the instances of rapid heating (1 and 2 s) which produces higher initial velocities in the direction of downward. We expect gravity to act on the molecules and pull them downward (and not up), especially as the molecules are in a vacuum, which should make the molecules deposit themselves on the lower part of the encircled paper. However, when rapid heating/evaporation of the iodine was attempted, a deposition of iodine on the lower part of the paper was observed. This could be explained by the fact that the blast heating results in a much higher kinetic energy/initial velocity of molecules and hence the downward projection and deposition.

The above experiment was performed under several geometries for further clarification, viz.: Evaporation of iodine (a) projecting the vapor upward, (b) projecting the vapor downward under atmospheric pressure, (c) projecting vapor downward within a grounded mu-metal shield.

However, the altered geometries did not affect the direction of the upward thrust (movement) of iodine molecules.

APPENDIX B: CALCULATION OF UPWARD FORCE ON WATER DROPLETS BY AIR MOLECULES

Figure 8 shows forces act underneath of a water droplet by air molecules in air convection.

m_w—mass of the water droplet ($5.016076270231703 \times 10^{-13}$); m_a—mass of the average air molecule ($5.550261559678224 \times 10^{-16}$); u_1—radius of the water droplet (5×10^{-6}); F_b—force due to buoyancy; v—the resultant upward velocity of the air molecule due to convection, in addition to its random velocities.

To keep the water droplet at equilibrium in still air,

$$m_w g \downarrow - F_b \uparrow = 2 \times \text{momentum of air column beneath wat.drop with length } v \qquad \text{(B1)}$$

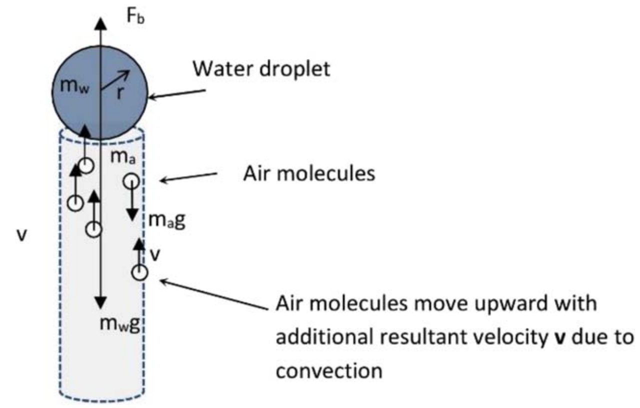

FIG. 8. (Color online) Forces acting on a water droplet in air convection.

Equation (B1) shows the relevant forces act on equilibrium.

It is assumed that the total force exerted by the air column is twice the momentum of air column beneath the cross section of the water droplet. However, to move the water droplet upward, the total momentum has to be transferred to the water droplet and relevant equation [Eq. (B2)] is shown below.

$$m_w g \downarrow - F_b \uparrow = \text{num. of air mole. beneath wat.drop@length } v \times m_a \times v^2 \qquad \text{(B2)}$$

Equation (B2) gives the velocity value of 32.6 cm/s.

Water droplets (m_1) are approximately 1.1×10^{13} times heavier than the air molecule (m_2) and according to the classical mechanics in this elastic collision, only a minute force is applied to the water droplet (calculation shows that there is hardly any energy/momentum transferred).

Relevant fundamental equations of classical mechanics to find the velocities of water droplet and air molecules are given below. v_1 and v_2 are velocities of the water-droplet and the air molecule after the elastic collision, respectively. u_1 and u_2 are velocities of the water droplet and the air molecule before the elastic collision, respectively,

$$v_1 = \frac{u_1(m_w - m_a) + 2m_a u_2}{m_w + m_2}$$
$$v_2 = \frac{u_2(m_a - m_w) + 2m_w u_1}{m_w + m_a}.$$

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