

Is there any possibility of doublet universe?

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Doublet universe can be formed by merging of source universe and sink universe within our visibility boundary range. The singularity points of the source-sink pair domain are nothing but act as black hole from which gravitational wave can travel within the visible boundary but nobody knows how far the energy of this traveling wave ends its dissipation. The similar effect can be seen in case of pond ripple after getting impacted by stone (or primordial atom) in two specific domains. Therefore, this paper reveals about the study of the pond ripple wave dynamics for understanding the possibility of doublet universe or the evidence of multiverse. Here, Buckingham pi theorem was used along with potential flow concept to model the impact between stone and pond surface. Further, a comparison was done with oscillating universe theory. The commercial softwares such as origin lab, Matlab was used to model the doublet universe.

1. Introduction:

According to potential flow theory [1], doublet flow formed when the separation distance between two source flow or two sink flow or source and sink flow tends to zero. As universe is the power set of all the properties which is happening at nature and the properties which are present in nature is the subset of that power set. Therefore doublet flow as an evidence one can find in nature when two stone thrown at same angle at zero separation distance on a liquid surface or pond surface due to which ripple generates. Similar things can also be possible in the universe when two quantized particle such as graviton [2] at zero separation distance fall on space time curvature which generates ripples which is termed as gravitational wave. This makes the importance of coining the term *Doublet Universe* over here. However, doublet flow or source flow or sink flow can be seen in case of pond ripples which are transverse wave that generates due to impact between stone and liquid surface. Since doublet universe means the association of two universes by capture theory [3]. Therefore here it makes the evidence to get the understanding regarding multiverse theory [4] as well as oscillating universe theory [5]. Though multiverse theory [6] is accepted by many cosmologists but the argument regarding the observational point beyond the horizon such as extrapolation upto 10^{100} times horizon distance or even more is very much alive [7]. However, oscillating universe theory depicts that universe exists between big bang and big crunch which is a cyclic event. Therefore to understand this two theory pond ripple wave generation with potential flow theory is the best idea that is available in nature. To understand the generation of ripple Buckingham pi theorem can be used that is a scheme for non dimensionalization and a key theorem of dimensional analysis which is the formalization of Rayleighs method of dimensional analysis [8, 9].

2. Model for strength of ripple wave generator

To establish a relation for finding the strength of ripple wave generator, Buckingham pi theorem [10] was used along with following assumptions to study an experimental situation (Fig. 1): (a) Temperature was taken as uniform and steady. Therefore, there will be no temperature term associated with pi terms. (b) Number of collisions of stone with medium particles was taken as 1 with respect to experiment facility. (c) Angle of impact of stone for experiment purpose was taken as 90° or $(3.14/2)$ or 1.57 i.e. a constant pi term.

In Fig. 1, motion of stone from impact point for stone at specific height to impact point on liquid surface was studied by using Buckingham pi theorem. Therefore from Fig. 1, it can be written as

$$f(\xi, \theta, \delta, \tau, \eta_c, m, v, F, E, a, g, A) = 0 \quad (1)$$

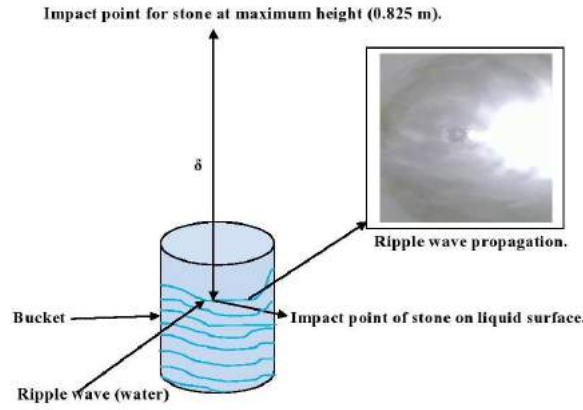


Figure 1. Schematic diagram of experimental setup and generated ripple wave propagation.

Where, ξ is the strength of ripple wave generator in cm^2/s , θ is the angle of impact of stone into liquid surface. Here it was taken as 1.57 for experiment, δ is the distance between impact point of stone and impact point on liquid surface in m., τ is the time required for stone to reach into the liquid surface in s., η_c is the total number of collisions in medium from impact point of stone into liquid surface impact point. Here it was assumed as 1, m is the mass of stone in kg., v is the velocity of stone in m/s., F is the impact force of stone in Newton, E is net energy (K.E. + P.E.) of stone for motion between impact point of stone to impact point of liquid surface in kW., a is the acceleration of stone in m/s^2 , g is the acceleration due to gravity, which is 9.81 m/s^2 and A is the surface area of stone in m^2 . Therefore, the governing equation for strength of ripple wave generator from the equation (1) is

$$\xi = \frac{1.57}{Ag} \frac{\delta^8}{\tau^7} \frac{m^2}{FE} \phi \left(\frac{\tau^3 av}{\delta^2} \right) \quad (2)$$

Experimental data show that the non dimensional term in equation (2) is approximately equal to 1 i.e. $\phi \left(\frac{\tau^3 av}{\delta^2} \right) \approx 1$.

3. Results and Discussion

To determine the strength of ripple wave generator an experiment was conducted to calculate the preliminary variables such as velocity of stone, acceleration of stone, impact force of stone, net energy of stone and ripple wave propagation velocity for understanding the ripple wave dynamics for different masses with respect to different heights such as 0.825 m, 0.725 m, 0.625 m and 0.525 m. Time of fall of stone from impact point to liquid surface was calculated by using stopwatch. The detailed information of the experiment are tabulated in Table 1 below. The

Table 1. Experimental details

Sl. No.	Equipments	Detailed information
1	Marbles (or stone)	Five marbles of different sizes: 0.023 m, 0.0205 m, 0.018 m, 0.0155 m, 0.015 m. Mass: 0.016 kg, 0.014 kg, 0.008 kg, 0.006 kg and 0.004 kg. Shape: Spherical
2	Vernier Calliper	Parco Company, 0 - 12.5 cm range.
3	Screw Gauge	Ajit Company, Range: 0 - 90 mm.
4	Buckets	Diameter of top most liquid surface in bucket - 0.2431 m, 0.2816 m
5	Tape	Libra Company, (0 - 1.5 m) range.

variation of impact force and net energy of stone with δ was studied to understand the mass variability, time of fall variability, velocity variability and acceleration of stone variability on impact of force and net energy results.

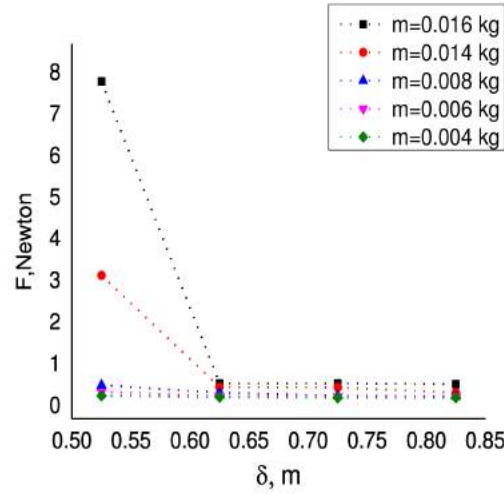


Figure 2. Impact force of stone of different masses on liquid surface variation with δ .

From Fig. 2, it can be noticed that impact force for higher mass stones such as 0.016 kg and 0.014 kg varies in the range of 0.1284 N - 7.6 N. But for lower mass stones it varies in the range 0.00724 N - 0.14 N. Also, it was seen that impact force of stone is more for low δ because at this distance stone has to suffer less collision or less resistance with media particles or medium.

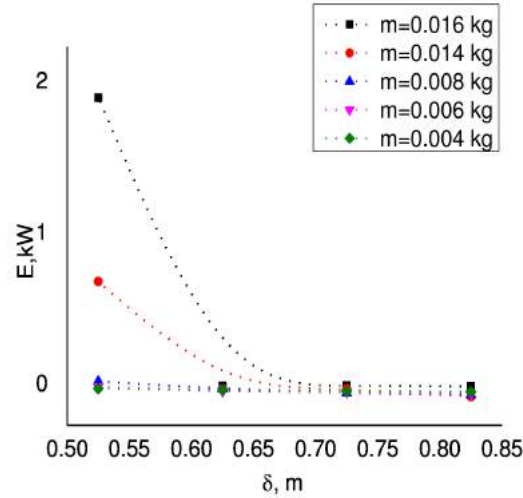


Figure 3. Required net energy for ripple generation of stone of different masses on liquid surface variation with δ .

From Fig. 3, it is seen that net energy varies - 0.00762 kW - 1.915 kW for higher mass stones whereas it varies - 0.00723 kW - 0.03944 kW for lower mass stones such as 0.008 kg, 0.006 kg and 0.004 kg. However, typically for lower mass stones motion due to gravity dominates kinetic motion which results negative net energy. To understand the behavior of ripple wave with bucket area variability, preliminary factor such as velocity of propagation of ripple wave (v_p) was studied. Propagation time was calculated by subtracting the time of fall for typical stone on the liquid surface from total time i.e. time of fall of stone plus required propagation time to standstill the liquid surface from undulation.

From Fig. 4 (a) and Fig. 4 (b) it can be observed that ripple wave propagation approximate velocity is more for

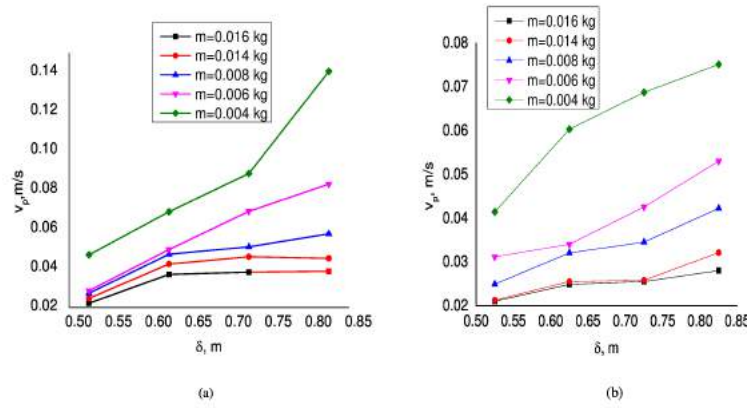


Figure 4. (a) Ripple wave propagation velocity variation with δ for bucket diameter 0.2431 m. (b) Ripple wave propagation velocity variation with δ for bucket diameter 0.2816 m.

lower mass stones compared to higher mass stones such as 0.016 kg and 0.014 kg. It is because during the impact with liquid surface higher mass stones lose net energy more compared to lower mass stones due to skin friction drag and shear resistance. This loss of energy is due to greater surface area. Therefore a simulation was done by using this results and universe size [11] which results if a particle dropped from - 2.02E27 m height on the space time curvature of the universe the propagation time it will take 8.574E28 second with propagation velocity 2.36E26 m/s. Now, equation (2) was recalled for strength of ripple wave generator calculation with the help of experimental data and then it was plotted as given below.

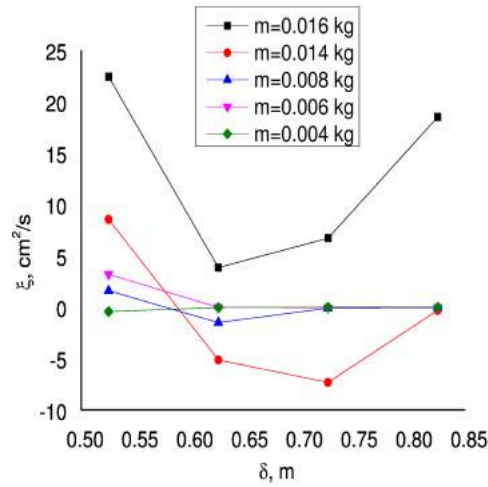


Figure 5. Variation of strength of ripple wave generator for different masses with δ .

From Fig. 5, it can be seen that strength of ripple wave generator fluctuates with height which is due to motion due to gravity and surface area of stone. However, in case of lower mass stones strength of ripple wave generator act as sink because of motion due to gravity dominates kinetic motion of stone in this case. The higher mass stones show almost similar variation of strength of ripple wave with height whereas lower mass stones show not much variation or fluctuation with height.

Fig. 6 was plotted using strength of the ripple wave generator and streamline function and velocity potential function [1]. The range of either side of the bucket was taken as (- 2, 2) cm in x and y direction.

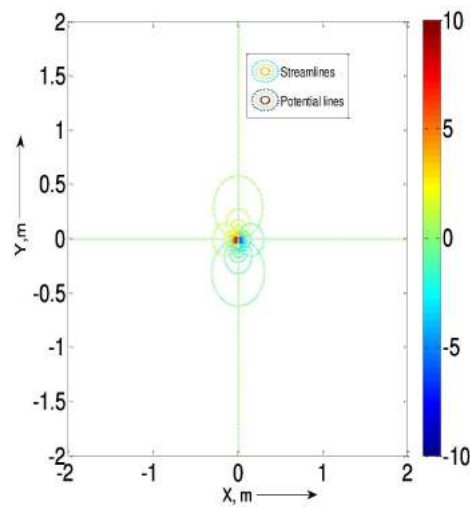


Figure 6. Matlab plot of streamlines and velocity potential lines of sink flow doublet universe of strength - $0.3 \text{ cm}^2/\text{s}$.

4. Conclusions

From above results and discussion it can be concluded that motion due to gravity dominates kinetic motion for lower mass stones that results negative net energy and sink flow. Above studies suggests that doublet universe can be possible for two merged source flow or two merged sink flow and merging of source- sink flow. Typically the study does not support oscillating universe theory fully because universe can also be possible due to two source/sink flow. So, the study partially supports oscillating universe theory as well as multiverse theory. Further studies can be done on this experiment for the possible evidence of parallel universe theory by varying the impact angle of stone and using LAB View analysis software for wave properties estimation.

5. Acknowledgement:

Authors likes to acknowledge Regional Science Center, Tirupati for their kind cooperation by providing space and required equipment during the experiment.

References

- [1] E. L. Houghton et al, *Aerodynamics for Engineering Students*, Elsevier, pp:150-163, ISBN:978-0-08-096632-8 (2012).
- [2] C. M. Will, *Physical Rev. D* **57(4)**, 2061 (1998) [arxiv:gr-qc/9709011].
- [3] J.R. Dormand, M. M. Woolfson, *MNRAS* **151**, 307 (1971).
- [4] Andrei Linde, arxiv:1512.01203[hep-th] (2015).
- [5] D. Ruth, L. Joachim, arxiv:gr-qc/951004/v2 (1996).
- [6] M. K. Munitz, *Journal of the History of ideas* **12(2)**, 231 (1959).
- [7] Ellis et al, *MNRAS* **347(3)**, 921 (2004).
- [8] E. Buckingham, *Phys. Rev.* **4(4)**, 345 (1914).
- [9] E. Buckingham, *Nature* **96(2406)**, 396 (1915).
- [10] E. Buckingham, *Transactions of the American Society of Mechanical Engineers* **37**, 263 (1915).
- [11] P. Davies, *The Goldilocks Enigma*, First Mariner Books, pp:43ff, ISBN-978-0-618-59226-5 (2006).