Hydrodynamic model of gravity as a secondary effect of interaction of electromagnetic dipoles and the hypothesis of superfluid space-time.

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Abstract

A hypothesis based on expriment is proposed according to which the fabric of space-time is a superfluid subatomic medium in which matter exists as a process of vortex collapse of caverns (cavitation). Vortices are considered as thermodynamic phenomena associated with thermal motion and release of free energy of the medium, which is confirmed experimentally in agreement with $E = mc^2$, and are quantized due to superfluidity. Gravity is interpreted as a secondary effect of interaction of EM dipoles, which is supported by the hydrodynamic model.

Introduction

Modern physics seeks to combine quantum mechanics, general relativity and electromagnetism, as well as to explain the nature of matter and gravity. In this paper, space-time is reconsidered as a superfluid subatomic medium, where magnetic fields arise as vortices, electric fields as pressure gradients, and matter as local inhomogeneities of these vortices. The hypothesis is based on hydrodynamic analogies. Vortices are interpreted as thermodynamic phenomena associated with the thermal motion of particles of the medium and the release of its free energy, which emphasizes the dynamic nature of the existence of matter. Additionally, the electromagnetic hypothesis of gravity (EMG) is integrated, according to which gravity is a derivative of EM interactions, namely the resultant force of dipole effects, which eliminates the need for an independent gravitational force.

Description of the model

1. Superfluid subatomic medium

Space-time is assumed to be a superfluid subatomic medium with zero viscosity, and matter is assumed to be vortices arising from the collapse of caverns. In such a medium, there is no internal friction, which allows vortices to remain stable indefinitely in the absence of external disturbances. The free energy of the medium or thermal motion is interpreted as quantum fluctuations. The electromagnetic field and matter in this model arise as a property of the dynamics of space, and not as an independent entity.

2. Vortex as a thermodynamic process

A vortex is considered as a thermodynamic process associated with the ordering of the chaotic energy of the medium. Unlike simple mechanical rotation, a vortex is the result of the collapse of a low-pressure zone, where the free energy of the medium becomes directed and concentrated in a vortex structure. This assumption is based on experimental observations:

Let's imagine a boat on the water with a pendulum installed. When the pendulum shifts to one side, the hull of the boat moves in the opposite direction, creating a low-pressure zone and turbulence behind it. After some time, due to the inertia of the water, this zone collapses, giving the boat a forward impulse. If the pendulum returns at a lower speed, the return impulse is weaker, and the resulting force pushes the boat forward. This experiment illustrates the classic problem of conservation of momentum, taking into account the added mass of water. The impulse is expressed as $p = m v$, where (m) includes the mass of water involved in the motion.

To simplify as much as possible: If you put your palm in water and move it back and forth perpendicular to its plane, the resistance during the return movement will be noticeably greater.

The photo (Fig. 1) shows a clear example. As the plate rises upward, a turbulent ring vortex forms behind it. After the plate stops, this vortex catches up with it, hits it from below and is reflected to the sides, expanding. This gives the plate an additional upward impulse.
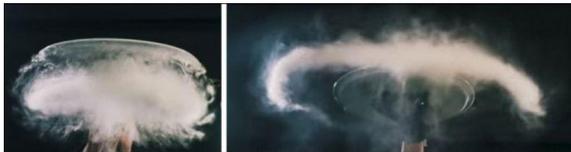

Fig. 1. Ring vortex under the plate during its movement and after stopping.

These examples show that the collapse of low-pressure zones transforms the chaotic thermal energy of the medium into directed motion, which underlies the flight of birds, the swimming of fish and other natural phenomena. A vortex is thus not just rotation, but a process of local ordering of energy.

Many modern studies consider the flight of birds as a kind of jet propulsion, during which they throw off vortices, and this creates thrust. This is similar to the principle described above, and these vortices are impulses of collapse reflected from the wing.

Let us imagine a homogeneous medium consisting of individual particles (Fig. 2). The only possible position of the particles relative to each other, in which absolute homogeneity is fulfilled, is tetrahedrons or, for simplicity, a triangular lattice in one plane, at the intersections of which the particles are located. Thus, all distances between the particles are the same. Particles interact with each other by attracting each other at a distance and repelling each other when they collide, which is due to the forces of molecular attraction and repulsion.

Let's assume that particle 1 receives momentum and moves in the direction of the other two. If we were to consider the particles as billiard balls, we would think that the momentum

would split into two. But in this case, we have the forces of molecular attraction and repulsion, which allow us to consider further interaction as a chain reaction based on the domino principle, where the momentum is transmitted infinitely due to the force of gravity. Following the logical path of the particles' movement, we will see that the momentum in a circle from both sides returned to the first particle that caused the action, which will lead to an infinite repetition of the process.
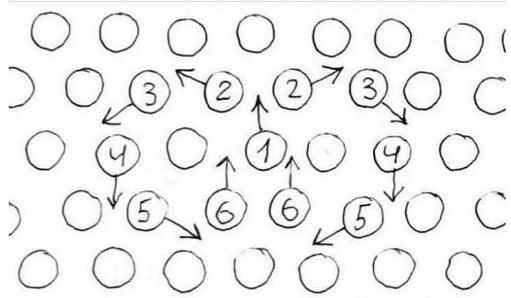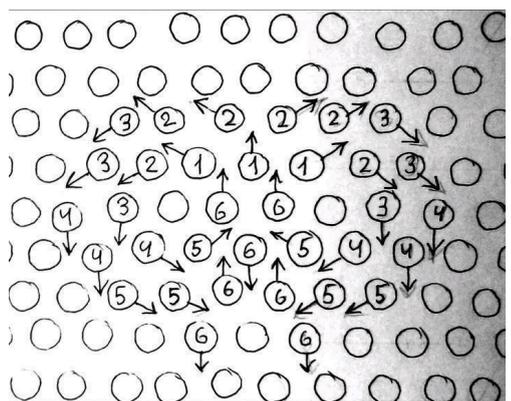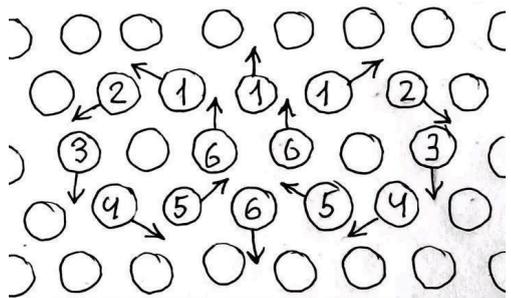

Fig. 2. Formation of a vortex as a result of momentum transfer by particles.

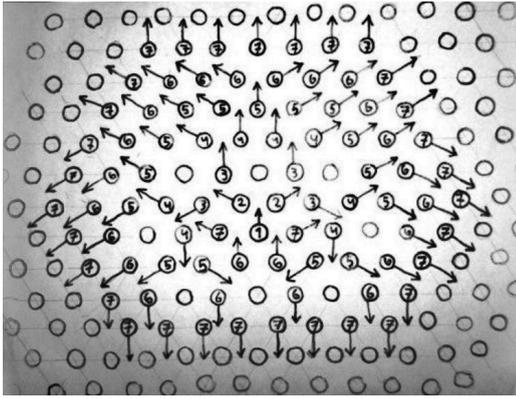Further evolution (Fig. 3, 4, 5) can be studied in computer models.

Fig. 3, 4, 5. Possible interpretations of the further evolution of the vortex.

3. Vortex as a particle and a wave

Vortices have a dual nature. On the one hand, they are localized in space and have mass, which gives them particle properties, such as momentum ($p = m v$) and the ability to reflect. On the other hand, a vortex can be represented as a wave or soliton (vortex ring). Elastic waves do not form vortices, but critical stress creates a gap, leading to vortex collapse.

Like an atom, a vortex can be described as a rotor with orbitals, where density gradients (Fig. 6) form a three-dimensional standing wave. An external influence changes the configuration of the vortex, similar to the transition of an atom to another energy level. At high energy, the vortex ring approaches a spherical shape with a toroidal structure inside, which is observed in the collapse of cavitation bubbles in high-speed photography frames (Fig. 7). This makes the vortex similar to atoms, stars and other spherical space objects. Spiral structures of galaxies, reminiscent of whirlpools, can be considered as a projection of a toroidal vortex onto a plane. The participation of the energy of the medium in the formation of the vortex corresponds to $E = mc^2$, emphasizing the similarity.
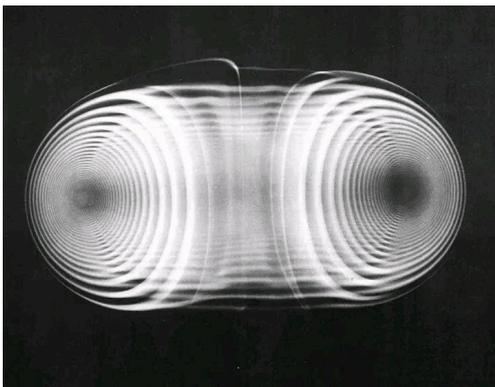

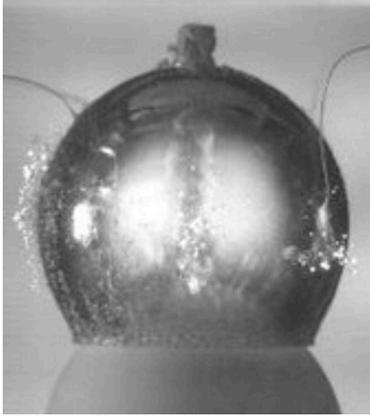Fig. 6. Density gradients in a ring vortex.

Fig. 7. Toroidal structure of a cavitation bubble.

The mass m of a particle is determined by the energy of a vortex in a superfluid medium with density. According to the Gross-Pitaevskii equation, a particle represents a local minimum of the medium's density. The rest energy is described as:

$$E = \int \frac{1}{2} \rho_v v^2 dV = mc^2$$

This explains the equivalence of mass and energy as the conversion of the medium's potential energy into the kinetic energy of the vortex.

4. Birth of matter

Gravitational waves create stresses in a superfluid medium, leading to ruptures and the formation of caverns - zones of low pressure. The collapse of these caverns forms toroidal vortices, which are electromagnetic fields:

Magnetic fields are the body of the vortices, and electric fields are pressure gradients that arise during compression or stretching of the medium.

Matter is local inhomogeneities, energy clots in the cores or intersections of vortices.

The free energy of the medium is converted into mass according to the equation E = mc^2. Superfluidity ensures the stability of vortices and their quantization, which is observed in superfluid helium. Elementary particles, such as electrons, are the cores of microscopic magnetic vortices, where the charge and spin are a consequence of the circulation of the medium. The magnetic moment of an electron can be associated with circulation. The pressure gradient generates an electric field directed from high-pressure areas to low-pressure areas. Large-scale magnetic fields of galaxies are macrovortices, and stars

and gas are irregularities caused by turbulence. Spiral waves from the center of the galaxy reach a critical voltage, causing cavitation in them, forming sleeves. Intergalactic gas threads are the initial stage of the appearance of matter, similar to cavitation threads when water is exposed to ultrasound (Fig. 8). The vortex, which occurs as a result of the collapse of a cavern, is an area of lower density relative to the surrounding medium. The final volume of the medium in the presence of a vortex in it occupies more space, which corresponds to the expansion of the universe. Thus, the expansion of the universe is equal to the volume of new matter.
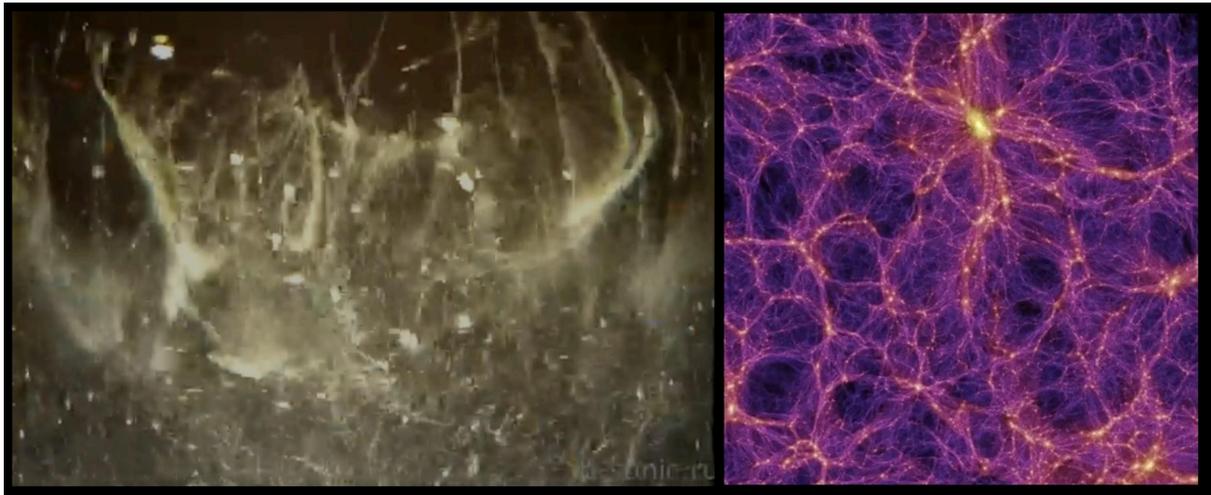

Fig. 8. Cavitation in liquid under the influence of ultrasound (left) and galactic filaments (right).

5. Gravity as a resultant of dipole interactions

Gravity is modeled as a secondary effect of EM fields, arising as a resultant force of dipole interactions in a superfluid medium. This is based on a hydrodynamic analog model supported by experiments.

Consider the following experiment:

A circular float on water with a motor (M) in the center (Fig. 9), which rotates a pendulum with a magnet at the end. A second magnet with the opposite pole is attached to the edge of the float. When the pendulum passes the second magnet, the attraction of the poles accelerates it in a certain phase, creating an asymmetry of oscillations.
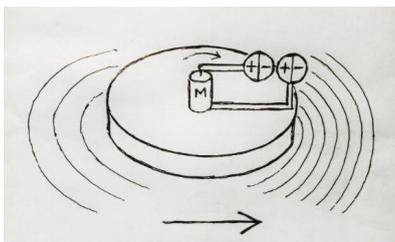

Fig. 9. Vibrating boat.

An asymmetrically oscillating float interacts with water. Fast forward jerks create a greater force of collapse of the turbulent zone behind the boat, and slow backward movements create a smaller force in front of it. The energy of the collapse is transmitted to the hull of the boat and as a result, a net force appears that pushes the boat forward, as indicated by the arrow.

Logically, the direction of the boat's movement should be perpendicular to the direction indicated, as the pendulum lever is applied during acceleration. And this happens if you compensate by adding the same pendulum (Fig. 10), but in fact the boat moves in the direction of the magnet on the edge of the float, as indicated by the arrow. At the same time, the real movement of the boat occurs along an arc and has a more complex character, reminiscent of the movement of a fish's tail.
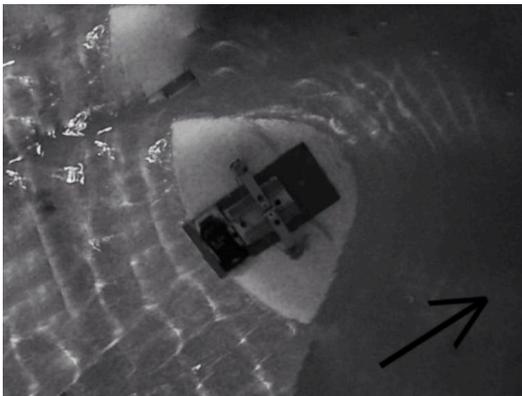

Fig. 10. A vibrating boat with two pendulums at the ends of a rod installed perpendicular to the direction of motion (indicated by the arrow). The accelerating magnet is located in the center between the pendulums. As a result of the motion, the waves in front and behind have different lengths. The shape of the boat does not play a key role, since when the thrust is reversed, the direction of movement changes accordingly.

Now let's consider an imaginary experiment:

The image shows two conventional hydrogen atoms (Fig. 11), each of which represents an oscillator. In the center of each is a dipole consisting of a positive charge (+) (the axis of rotation) and a negative charge (-) (the pendulum weight), connected by a line. These dipoles symbolize pendulums that rotate around a positive charge.

They have an equal number of charges, but their pendulums, having a negative charge, repel each other and enter into resonance, avoiding convergence.
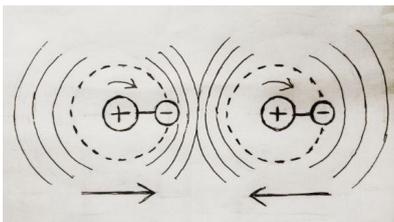

Fig. 11. Two conventional hydrogen atoms as oscillators with pendulums.

The negative charge of each atom interacts with the positive charge of the neighboring one. This interaction leads to a temporary acceleration of the pendulums' rotation, which in turn leads to asymmetric oscillations of both atoms.

The asymmetry of the oscillations is manifested in the fact that both atoms make jerks in the direction of each other with a greater speed than in the opposite direction.
Provided that the subatomic environment, forming collapse vortices as virtual photons and interacting with the atoms, creates the same effect as a liquid, the atoms will be mutually attracted.

Adding a third atom does not screen the attraction, since the resonance phase preserves a "window" for acceleration (Fig. 12).
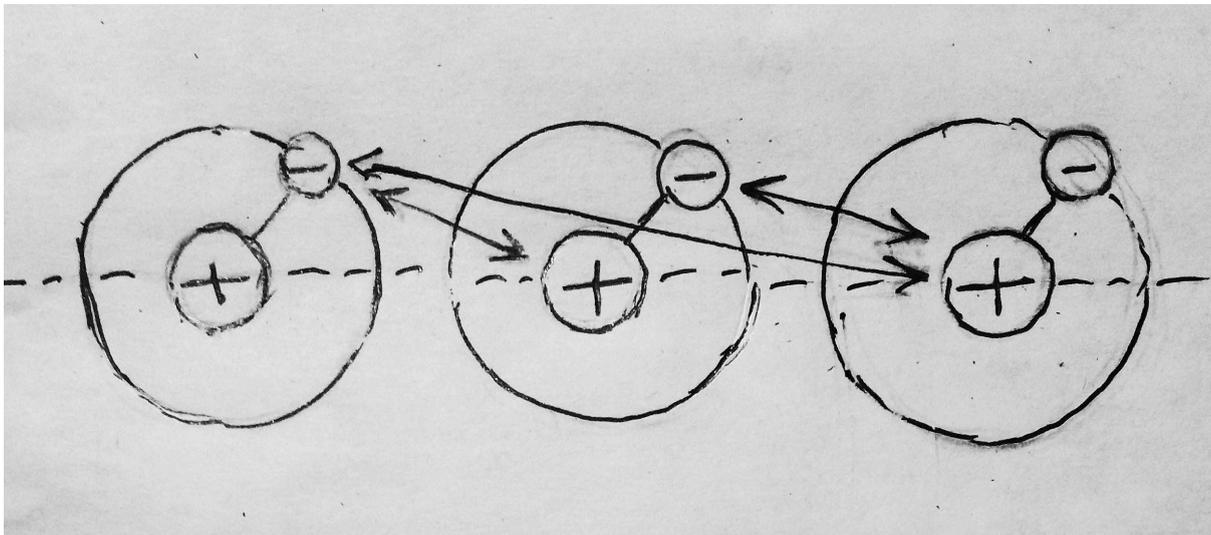

Fig. 12. Gravitational interaction of three atoms.

At small distances, atoms shield each other from environmental disturbances, forming a zone of low pressure between them, which increases attraction. This explains interatomic attraction and gravity by a single force - EM interaction.

Heisenberg's uncertainty principle states that in areas of high probability density of an electron, its momentum is less certain, which increases kinetic energy. In the model, pendulums accelerate opposite the nucleus of a neighboring atom, corresponding to a high probability density. The overlap of orbitals creates a zone of alternating pendulums, which is consistent with the probability cloud.

In areas close to neighboring atoms, orbitals are compressed and if the electron is conventionally represented as a ball in an orbit, it travels a shorter path, which may mean its greater energy and speed,

Orbitals are compressed in the direction of attraction, increasing the speed of the electron, which corresponds to the model with pendulums. In addition, orbitals can be considered as waves, which corresponds to the wave analogies of a boat.

In the Bohr model, in the ground state, the electron moves along a circular orbit, but its plane is arbitrary. In the pendulum model, the electron can move in all planes of orbits in all directions simultaneously, but it must not change speed when passing in front of or behind the nucleus relative to the gravitating object.

This implies an eccentricity of the shell, which contradicts the condition of the ground state of the atom, in which the angular momentum of the electron is 0.

But perhaps the mathematical model describes ideal conditions, that is, as if we conditionally take the Earth as an ideal sphere. Whereas in reality, there is still heterogeneity and ideal conditions are unattainable. Such heterogeneity of the shell is indeed observed in the ground state of the atom (Fig. 13) and it would be worth studying how it behaves in relation to gravity.

An atom undressed   ©NewScientist

Electrons have quantum properties so can be in many places at once, making it hard to image atoms. By combining snapshots of many electrons at once, hydrogen atoms have now been imaged at four energy levels (increasing from a to d)
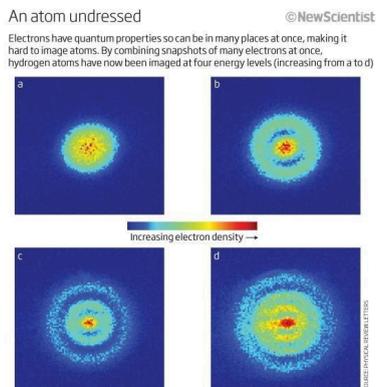
Increasing electron density →

Fig. 14. Hydrogen atom with four electron energy levels.

In hydrodynamics, the interaction force between two pulsating bodies in a superfluid medium is described by the Bjerknes formula:

$$F = \frac{4\pi \rho_v R^4 a^2 \omega^2}{r^2}$$

Where *a* is the amplitude of the asymmetric oscillation.

To align this model with Newton's Law of Universal Gravitation, we calculate the required amplitude *a* by substituting the proton mass and the frequency of quantum oscillations, we obtain:

$$a \approx L_p \approx 1.6 \times 10^{-35} \text{ m}$$

Where *Lp* is the Planck length. Consequently, the gravitational constant *G* can be expressed through the fundamental parameters of the medium:

$$G = \frac{4\pi \rho_v R^4 \omega^2 L_p^2}{m^2}$$

This suggests that gravity is an "echo" of Planck-scale fluctuations within the superfluid vacuum.

Conclusion

The model of superfluid space-time, where matter is vortices and gravity is a consequence of EM-dipole interactions, offers a unified approach to fundamental interactions. Experimental analogies confirm the physical basis, and cosmological consequences explain the expansion of the Universe and the structure of galaxies. The hypothesis requires theoretical and experimental revision to test it on subatomic and cosmological scales.

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Video

https://youtu.be/oUSLfehZaIk?si=MPI9wXAEtkm6mFko

Video demonstrates various configurations and interactions of vortex rings, as well as an experiment with a plate during the performance of tricks.
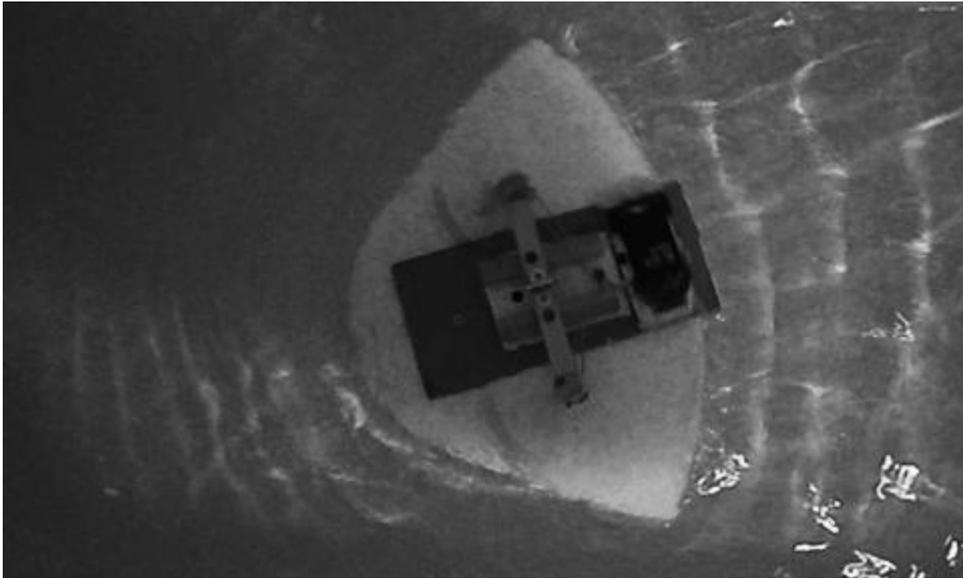
https://youtu.be/PnTP0lYFCSg?si=T8MjpaLhwpd_rE0E

Movement of the vibrating boat.

https://youtu.be/9U1y6qRET2I?si=uWNLGJK6QAsHmJje

Cavitation in water and vegetable oil.

To improve readability AI Grock was used.