

# Nanostructures for energy harvesting

## Research proposal

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There are many research efforts in area of new applications of nanostructures for light energy harvesting. Also there are very promising results on mechanic-electricity energy conversion in piezoelectric nanostructures. Our team offer new direction of energy harvesting technologies. It is application of special nanomaterial for direct heat energy conversion in process of elastic interaction with molecules of environmental air or other gas. We can get a new type of aerospace propulsion technologies.

Author started this research topic in 1996, following experiments made by Harry W. Bull, it was published in Popular Science, vol. 126, 1935.

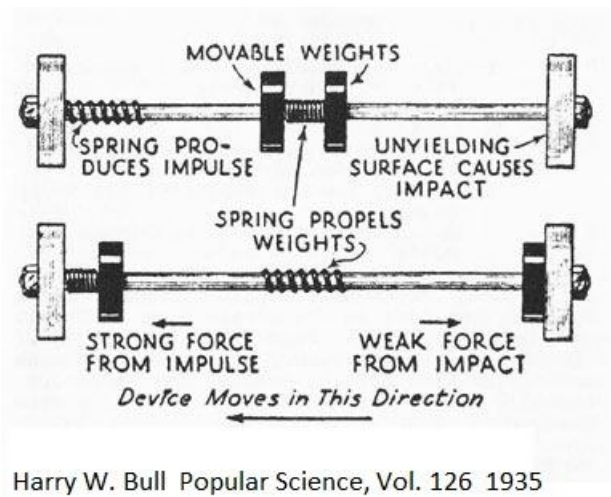


Fig.1

In 1996 Alexander V. Frolov demonstrated it for international conference “New Ideas in Natural Sciences”, St.-Petersburg, Russia. Scheme of this experiment is Fig.2.

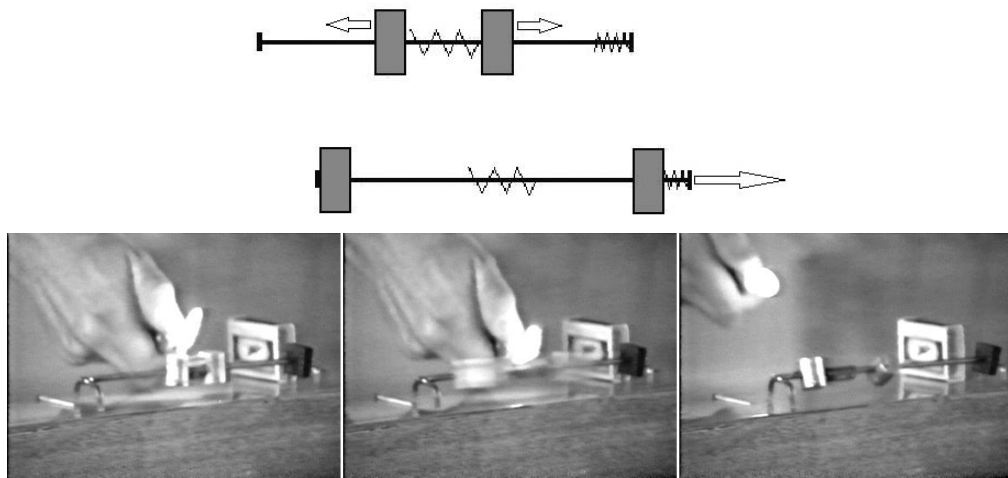


Fig.2 Scheme and photo of Frolov's experiment, 1996

Conclusion from this experiment is very interesting. Interaction of two bodies can provide reactionless propulsion force in the case of different conditions of collision. In experiments above we can see elastic collision from one side (rubber at right side) and non-elastic collision from another side. So, we have here two different conditions of interaction, i.e. impact and impulse. Propulsion force observed here to the side of elastic collision.

There is a question about the law of conservation of energy. Really, here is no a violation of the law. On one side of the collision we can see transformation of kinetic energy of the moving body into unidirectional force of the device and on another side of collision we can see transformation of kinetic energy of the moving body into heat energy. Amount of the heat here is equivalent to generated unidirectional force.

Practical application of this idea cannot get some real technical solution before nanotechnologies. In 2003 Mr. Michael P. Beshok published an article “Energy of Air”, New Energy Technologies magazine, #4 (13), 2003. His ideas were based on application of nanostructures for redirecting of air molecules, Fig.3.

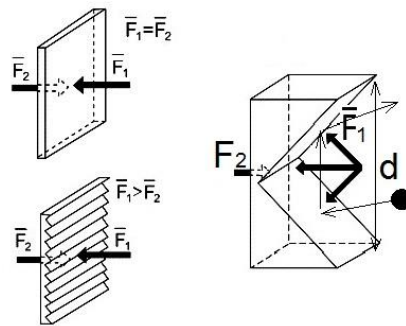


Fig.3 Ideas on redirecting of molecules

Important aspect of this method is related with understanding of molecular motion in scale of 50-100 nm for normal conditions in air (1 Atm and 27C degree). It is average free path length between collisions of molecules. So, in this scale of surface relief we can consider interaction of every molecule instead of statistic situation.

Perspective of this idea is very nice. Atmosphere air pressure is about 10 ton per sq.m. Let's suppose we can create 10% gradient of air pressure for some experimental setup, it can be a plate with one side surface nanorelief. Theoretically, propulsion force should be about 1 ton per sq.m. Any small experimental setup with surface of several square mm can demonstrate this effect on digital scales.

Alexander V. Frolov named this new material Active Force Material (AFM). The propulsion force here is active, i.e. non-reactive.

Theoretically, we can join several plates of AFM in one cubic form box to get compact propulsion unit for aviation and aerospace, Fig.4. Also we can plan practical application of this method for any rotation machine to provide powerful torque of the rotor.

It is not free energy “from nothing”. AFM will provide direct conversion of environmental heat energy to useful work. We have to harvest part of kinetic energy of gas molecules to convert it in heat radiation due to elastic deformations.

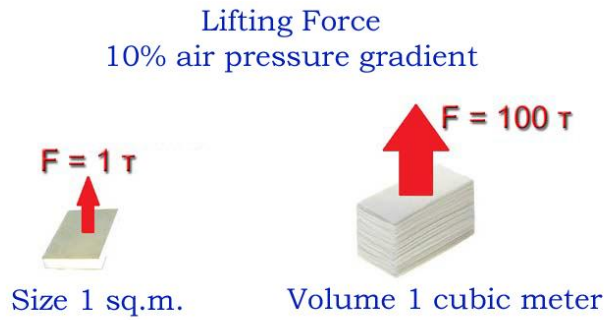
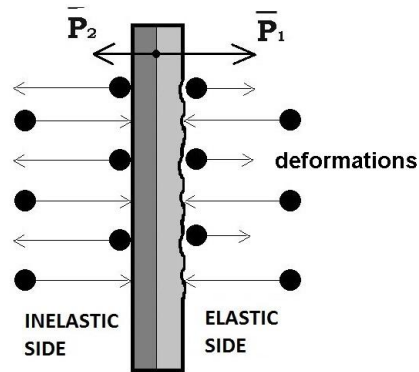


Fig.4

Next step was made in 2011 – 2013 period. Alexander V. Frolov organized delivery of some nanomaterials to his laboratory and started measurements with aerogel and Ti2O3 nanotubes. Results on redirecting were not so significant to report it. It is obviously that we need to work with elastic nanoelements, for example it can be some small diameter nanowires. Key factor is elastic properties to get the estimated effect, look at Fig.5.



Future development of this project depends on our partnership with other research labs in the World. My company Faraday Lab ltd. was closed in 2016 and it is planned to create a new research laboratory.

Contact me with proposals on joint experimental work on the topic.



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