Article Stability of AB matter corrected IJEE and me 4 7 11

AB-needles: Fantastic Properties and Application in Energy

A. A. Bolonkin

C&R, 1310 Avenue R, #6-F, Brooklyn NY, 11229, USA

abolonkin@juno.com

Abstract- **Author offered and considered possible super strong nuclear matter [1]. But many readers asked about stability of the nuclear matter. It is well-known that the conventional nuclear matter having more than 92 protons or more than 238 nucleons became instable. In given work the author shows the special artificial forms of nuclear AB-matter which make its stability and give the fantastic properties. For example, by the offered AB-needle you can pierce any body without any damage, support motionless satellite, reach the other planet, and research Earth's interior. These forms of nuclear matter are not in nature now, and nanotubes are also not in nature. That artificial matter is made by men. The AB-matter is also not natural now, but researching and investigating their possibility, stability and properties are necessary for creating them.**

Keywords- Femtotechnology; FemtoTech; AB-matter; AB-needle; Application AB-matter; Stability AB-matter

I. INTRODUCTION

A. Brief History

On December 29, 1959 the physicist Richard Feynman offered his idea to design artificial matter from atoms and molecules at an American Physical Society meeting at Caltech. If he was not well-known physicist, the audience laughed at him and drove away from the podium. All scientists accepted his proposal as joke. How can you see the molecule? How can you catch the molecule? How can you connect it to other? How many millions of years you will create one milligram of matter ? And thousands of same questions having no answers may be asked. Any schoolboy has seen that Feynman proposal is full of fantasy which does not have relation to real technology. About 40 years the scientists had not found a way for implementation of this idea. But only in the last 15 years we have initial progress in nanotechnology. On the other hand, progress is becoming swifter as more and better tools become common and as the technical community grows. On 14 February 2009 the author offered the idea of design of new matter from protons, neutrons and electrons, made initial research and published the article about it [1]. These particles in million times are smaller than molecules. He researched and showed the new AB-matter will have the fantastic properties. That will be in millions times stronger than nanotubes and can keep the millions degrees of temperature. That may be invisible and permeable to ordinary matter. The many readers, who did not read carefully the author's article and who remembered from school course that the nucleus became unstable if number of protons is more than 92 or number of nucleons is more than 238, raised the cry that the AB-matter is impossible. They have not seen the main difference between conventional matter (conventional nucleus) and AB-matter. The conventional matter has nucleus

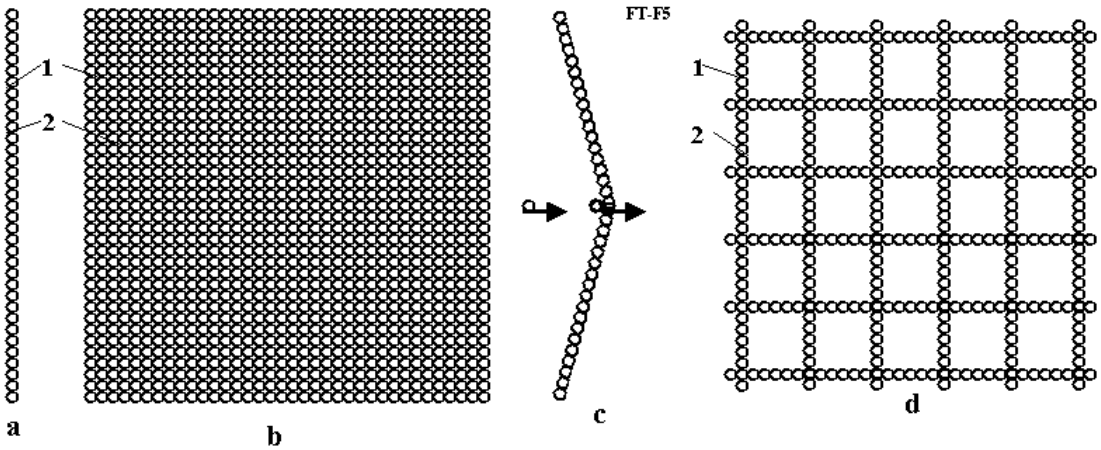

Fig. 1 Some forms of AB-matter (a) single string of the AB-matter (AB-needle); (b) continuous film from nuclear matter (nuclear grapheme); (c) cross-section of a matter film (side view). AB film under blow from proton or conventional molecular matter; (d) – net from the single strings (AB-needles). *Notations*: 1 – nucleons; 2 – electrons near AB-Matter.

which has a chaotic spherical LUMP (nucleus) of nucleons, the AB-matter is line from nucleons not having the lump. The author considers below this AB-line and shows that line is stable and has surprise property: one is a high rigid rod (needle), of which the compressed force does not depend on rod length! With this AB-rods (needles) you can support the Earth's satellite, reach the other planets, penetrate into the Earth interior and into any molecules of man without damage of its body.

B. Short Information About Offered Matter

In [1], it is shown the AB-matter may have forms (Fig. 1).

The main forms are: "a"- single AB-string (AB-needle), "b"- AB-film (plate), and "d**"** is net. From AB-needles may be design the many other forms (Fig. 2, taken from [1, Fig. 6]). That is net, cube, columns, tube and so on.

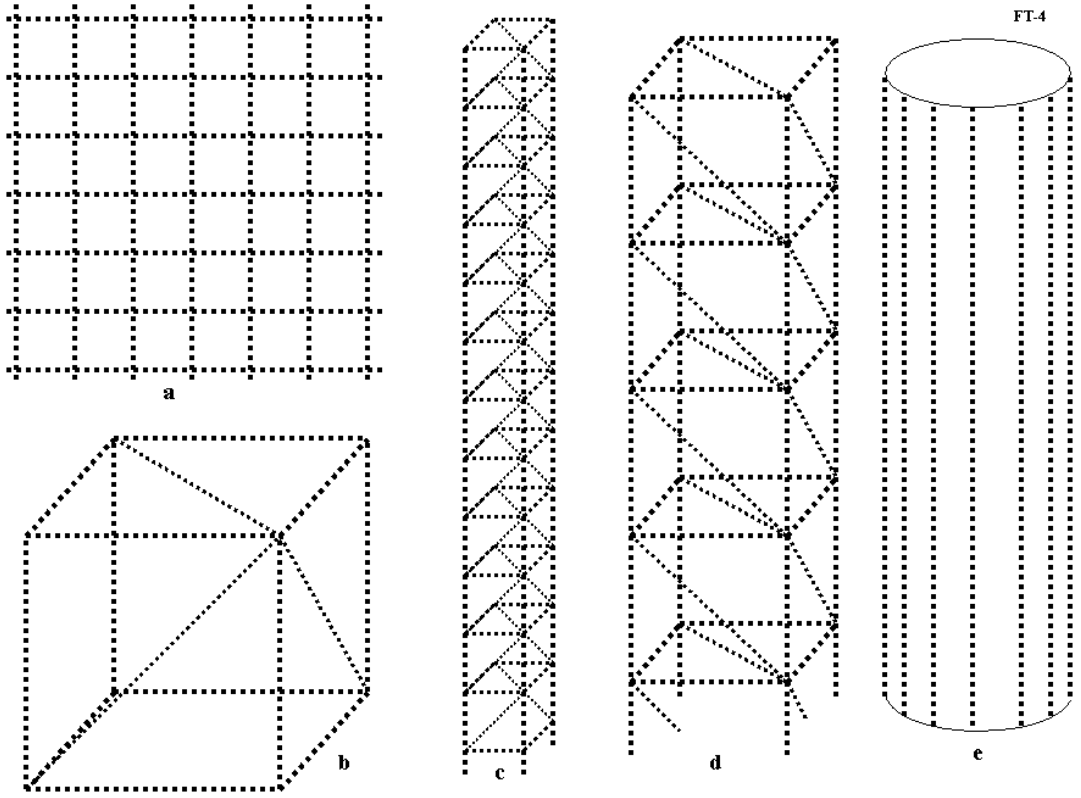

Fig. 2 Structures from nuclear AB-strings (AB-needles) (a) nuclear net (netting, gauze); (b) primary cube from matter strings; (c) primary column from nuclear strings; (d) large column where elements are made from primary columns; (e) tubes from matter strings (AB-needles) or matter columns.

C. AB-Matter

In conventional matter made of atoms and molecules the nucleons (protons, neutrons) are located in the nucleus, but the electrons rotate in orbits around nucleus in distance in millions times more than diameter of nucleus. Therefore, in essence, what we think of as solid matter contains a relatively 'gigantic' vacuum (free space) where the matter (nuclei) occupies only a very small part of the available space. Despite this unearthly emptiness, when you compress this (normal, non-degenerate) matter the electrons located in their orbits repel atom from atom and resist any great increase of the matter's density. Thus it feels solid to the touch.

The form of matter containing and subsuming all the atom's particles into the nucleus is named *degenerate matter*. Degenerate matter is found in white dwarfs, neutron stars and black holes. Conventionally this matter in such large astronomical objects has a high temperature (as independent particles) and a high gravity adding a forcing, confining pressure in a very massive celestial objects. In nature, degenerate matter exists stably (as a big lump) to our knowledge only in large astronomical masses (include their surface where gravitation pressure is zero) and into big nuclei of conventional matter.

Our purpose is to design artificial small masses of synthetic degenerate matter in form of an extremely thin strong thread (fiber, filament, string, needle), round bar (rod), tube, net (dense or non-dense weave and mesh size) which can exist at Earth-normal temperatures and pressures. Note that such stabilized special form matter in small amounts does not exist in nature as far as we know. Therefore author has named this matter AB-matter. Just as people now design the thousands variants of artificial materials (for example, plastics) from usual matter, we soon (historically speaking) shall create many artificial, designer materials by nanotechnology (for example, nanotubes: SWNTs (amchair, zigzag, ahiral), MWNTs (fullorite, torus, nanobut), nanoribbon (plate), grapheme, buckyballs (ball), fullerene). Sooner or later we may anticipate development of femtotechnology and create such AB-matter. Some possible forms of AB-matter are shown in Fig. 3.

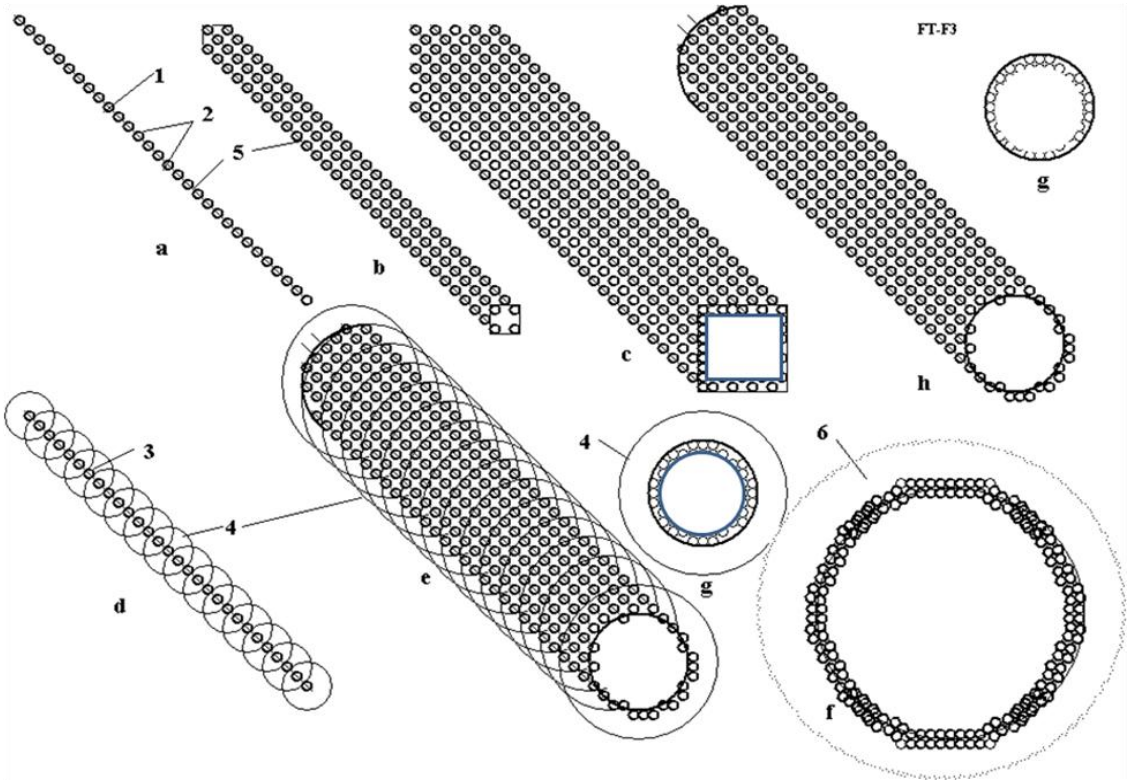

Fig. 3 Design of AB-matter from nucleons (neutrons, protons, etc.) and electrons (a) linear one string (monofilament) (fiber, whisker, filament, thread, needle); (b) ingot from four nuclear monofilaments; (c) multi-ingot from nuclear monofilament; (d) string made from protons and neutrons with electrons rotated around monofilament; (e) single wall femto tube (SWFT) fiber with rotated electrons; (f) cross-section of multi wall femto tube (MWFT) string; (g) cross-section of tube; (h) single wall femto tube (SWFT) string with electrons inserted into AB-matter. *Notations*: 1–nuclear string; 2-nucleons (neutrons, protons, etc.). 3-protons; 4-orbit of electrons; 5-nucleons; 6-cloud of electrons around tube.

The main difference between the AB-matter and conventional matter is a strict order of location the proton and neutrons (for example: proton-neutron-proton-neutron) in line (string) or in the super thin (in one nucleon) plate (nuclear graphene). That gives the strong tensile stress (electrostatic repulse force) which does not allow the nucleons to mix in messy clump (ball). This force is less than a nuclear force if the AB-matter has a form where the most protons are located far from one another, where the nuclear force from the far protons is absent. That is in line, net and plate (Fig. 1a, b, d), but that may be absent in the solid beam, rod (Fig. 3c, d) if their cross-section area contains a lot of nucleons. The other problem: compensation of the positive charges is solved by rotating electrons around the AB string, rod, tube, net (grid) or an electron cloud near the plate [1] or the electron locates near nucleons.

D. Using the AB-matter

The simplest use of AB-matter is strengthening and reinforcing conventional material by AB-matter fiber. As is shown in the 'Computation' section [1], AB-matter fiber is stronger (has a gigantic ultimate tensile stress) than conventional material by a factor of millions of times, can endure millions degrees of temperature, and does not accept any attacking chemical reactions. We can insert (for example, by casting around the reinforcement) AB-matter fiber (or net) into steel, aluminum, plastic and the resultant matrix of conventional material increases in strength by thousands of times—if precautions are taken that the reinforcement stays put! Because of the extreme strength disparity design tricks must be used to assure that the fibers stay 'rooted'. The matrix form of conventional artificial fiber reinforcement is used widely in current technology. This increases the tensile stress resistance of the reinforced matrix matter by typically 2–4 times. Engineers dream about a nanotube reinforcement of conventional matrix materials which might increase the tensile stress by 10–20 times, but nanotubes are very expensive and researchers cannot decrease its cost to acceptable values yet despite years of effort. Another way is to use a construct of AB-matter as a continuous film or net (Fig. 2b, d) or as the AB-needles (Fig. 2).

These forms of AB-matter have such miraculous properties as invisibility, superconductivity, zero friction, etc. The ultimate in camouflage, installations of a veritable invisible world can be built from certain forms of AB-matter with the possibility of being also interpenetable, literally allowing ghost-like passage through an apparently solid wall. Or the AB-matter net (of different construction) can be designed as an impenetrable wall that even hugely destructive weapons cannot penetrate.

The AB-matter film and net may be used for energy storage which can store up huge energy intensities and used also as rocket engines with gigantic impulse or weapon or absolute armor (see computation and application sections in [1]). Note that

in the case of absolute armor, safeguards must be in place against buffering sudden accelerations; *g*-force shocks can kill even though nothing penetrates the armor!

The AB-matter net (which can be designed to be gas-impermeable) may be used for inflatable construction of such strength and lightness as to be able to suspend the weight of a city over a vast span the width of a sea. AB-matter may also be used for cubic or tower solid construction as it is shown in Fig. 3. Detailed computation of properties of the AB-matter is in [1]. Our purpose is to show that the curtain forms of AB-matter will be stable.

II. LAW OF STABILITY OF THE NUCLEAR AB-MATTER

A. Short Information About Atom and Nuclei

Conventional matter consists of atoms and molecules. Molecules are collection of atoms. The atom contains a nucleus with proton(s) and usually neutrons (except for Hydrogen-1) and electrons revolve around this nucleus. Every particle may be characterized by parameters as mass, charge, spin, electric dipole, magnetic moment, etc. There are four forces active between particles: strong interaction, weak interaction, electromagnetic charge (Coulomb) force and gravitational force. The nuclear force dominates at distances up to 2 fm (femto, 1 fm = 10^{-15} m). They are hundreds of times more powerful than the charge (Coulomb) force and million-millions of times more than gravitational force. Charge (Coulomb) force is effective at distances over 2 fm. Gravitational force is significant near and into big masses (astronomical objects such as planets, stars, white dwarfs, neutron stars and black holes). Strong force is so overwhelmingly powerful that it forces together the positively charged protons, which would repel one from the other and fly apart without it. The strong force is key to the relationship between protons, neutrons and electrons. They can keep electrons into or near nuclei. Scientists conventionally take into attention only the strong force when they consider the nuclear and near nuclear size range, and the other forces on that scale are negligible by comparison for most purposes.

Strong nuclear forces are anisotropic (non-spherical, force distribution not the same in all directions equally), which means that they depend on the relative orientation of the nucleus. The proton has a magnetic moment which produces the magnetic force. This force orients the proton in magnetic field and helps to keep the form of AB-matter.

Typical nuclear energy (force) is presented in Fig. 4. The nuclear and electric forces can be attractive and repulsive. When it is positive the nuclear force repels the other atomic particles (protons, neutrons). When nuclear energy is negative, it attracts them up to a distance of about 2 fm. The value r_0 is usually taken as radius of nucleus.

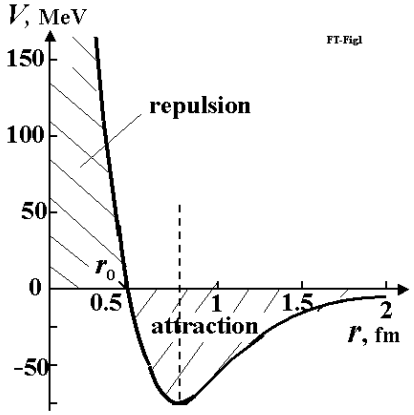

Fig. 4 Typical nuclear force of nucleus. When nucleon is at distance less than 1.8 fm, it is attracted to nucleus. When nucleon is very close, it is repulsed from nucleus [11].

B. Law (Necessary Conditions) of Stability the AB-matter

The necessary condition (prerequisite law) of stability the AB-matter are as following:

1) The number of protons must be less approximately 90 into a local sphere of radius 3 fm in any point of AB-matter;

2) The number of nucleons must be less approximately 240 into a local sphere of radius 3 fm in any point of AB-matter;

3) The AB-matter contains minimum two protons.

That law follows from relation between attractive nuclear and repulsive electrostatic forces into nucleus. The nuclear force is short distance force (2 fm), the electrostatic force is long distance force. When number of protons is more than 92, the repulsive electrostatic force may become more than nuclear force and electrostatic force may destroy the AB-matter. That law means the number of nucleons in any cross-section area AB-matter design of Fig. 3 must be less than 37.

The press strong possibilities of the AB-matters are very large because AB-needles has the surprising property discovered

by author – keep the huge press force in any length of AB-needle (transfer the pressure to any long distance). That property is described in next paragraph.

III. AB-NEEDLES

The most important design of AB-matter is connection of nucleons in string (Fig. 5a, b, c). That may be only protons *pppp*…. (Fig. 5a), proton-neutron-proton-neutron-…. (*pnpn*….)(Fig. 5b), proton-neutron-neutron-proton-neutron-neutron-…. (*pnnpnn*….)(Fig. 5c). The ends of AB-string contains the protons. The electrostatic repulse force of these end protons is not balanced and creates the strong repulsive force 3 (Fig. 5c,d,e) which stretches the AB-string. That helps to keep the string form and other forms (plate, tube, beam, shaft, rod, etc.) of AB-matter presented in Figs. 3, 5. This is very important properties. This property does not have the conventional molecular matter, because the conventional matter contains the neutral molecules. The charges of ions in conventional matter locate far from one another and repulsive force is small. That property discovered by author gives the AB-string the amusing feature: an independence of the safety press stress from length of the nuclear string. Remand: the safety press force of long conventional matter strong depends on length of wire, beam, shaft, etc. According to the Euler's law the safety compressive force in the ordinary matter is inversely proportional to the square of the length of the rod. If the length of rod is more than the safety length, the construction losses the stability (one is bending). You cannot push the car a thread or thin wire having one km length. They bend. The AB thin string can pass the compressive force for any length of string. That is why it is named the AB-needle. AB-needle allows penetrating into any conventional matter, into the interior of Earth, planets, Sun. They allow making the interplanetary trips and investigations of planet from Earth.

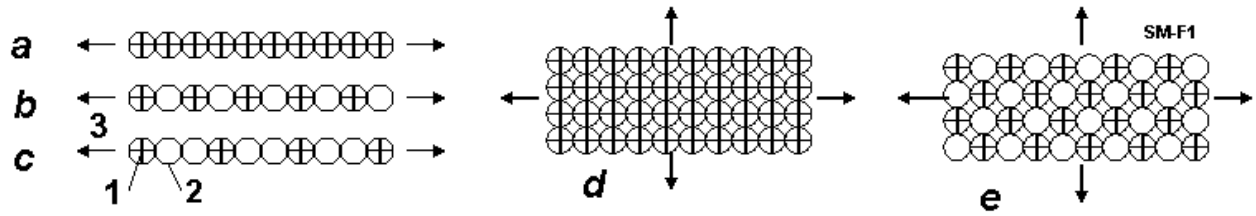

Fig. 5 Connection of nucleons in string (needle) (Fig. 2a, b, c) and film, plate (Fig.5d, e) and Coulomb (electrostatic, repulse) force. *Notations*: 1-protons, 2-neutrons, 3-repulse (Coulomb) force from protons.

A. *Computation (Estimation) of Forces in AB-needles*

Let us estimate the forces in AB-needle.

1) Nuclear Attractive Force:

The radius of proton is r = 0.877 fm (10^{-15} m). The connection energy of proton and neutron *pn* (^{2}H or ^{2}D) is about E = 1 MeV = 1.6×10^{-13} J; the connection energy of *pnn* (^{3}H or ^{3}He) is 3 MeV; the energy of *pnpn* (^{4}He) is 4 MeV. Let us take the average connection energy 2 MeV. The distance (where the nuclear force is active) is about l = 1 fm. Consequently the average attractive nuclear force is

$$F = \frac{E}{l} = \frac{2\times1.6\times10^{-13}}{10^{-15}} = 320\ N \tag{1}$$

The maximum attractive nuclear force is approximately in two times more, about 600 N. That is huge value because the cross-section area of AB-needle is millions times less than the diameter of the simplest molecules of hydrogen. Note: this force appears only when the outer force went to break the AB-noodle. If there is no outer tensile force, the internal strong nuclear force equals zero.

2) The Repulse Electric Force Between Protons:

Let us consider the AB-needle contains only protons *pppp*... (Fig. 5, mark 1). The repulse force between two protons equals

$$F_{1p} = k\frac{e^2}{(2r)^2}, \tag{2}$$

where k = 9 10^9 . Substitute an electric charge e = 1.6· 10^{-19} C and $2r = d$ = 1.754 fm. We receive F_{1p} = 74.8 N. The electric repulsive force decreases with distance $d = 2r$ between protons. If we summarize the repulsive force from all protons in line *pppp*…. of AB-needle (fig.5, marked 1), we receive

$$F_p = 1.64\ F_{1p} \approx 123\ \text{N}. \tag{3}$$

That means the AB-needle has gigantic internal stress which extends the AB-needle. That extended stress is less than the attractive maximum nuclear force and one does not depend on length of AB-needle. This extended stress decreases the maximal outer stretch force but one allows to keep the AB-needle the compress force while they are less than extended force.

If the press force is more than extended force the AB-needle does not break that only bends and continues to keep the maximal press force.

In case the AB-needle has form *pnpn*… (Fig. 5 marked 2) the distance between protons decreases in two times. That means the force F_p (3) decreases in four times ($2^2 = 4$) and equals $F_p \approx 30$ N. In case *pnnpnn*… (Fig. 5, mark 3) the force F_p (3) decreases in nine times ($3^2 = 9$) and equals $F_p \approx 14$ N. This tensile stress is transmitted through the protons to other end of AB-needle. That means the large pressure on the ends of AB-needle is passing along thin AB-needle through electrostatic repel force and one does not depend on length of AB-needle.

Some constructions from AB-string are shown in Fig.6.

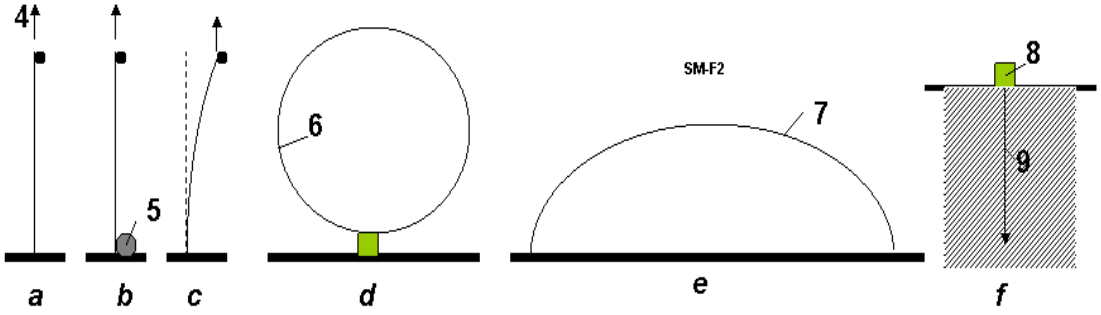

Fig. 6. Some construction from AB-string. *Notations*: *a* – vertical string (AB-needle). The big lift (support) force 4 does not depend from length; *b* – lifting the load to any altitude. 5 - spool of AB-string; *c* – stability of AB-string; *d* – ring 6 from AB-string; *e* – bridge (long arm) from AB-string; *f* – research of the Earth crust interior: 8 - installation (spool of AB-needle), 9 – AB-needle (string, cable).

AB-needls may be illustrated by a children long inflatable air-balloon (Fig. 7a). This press force also does not depend on length of balloon. The force is transferred by compressed air. This idea was used by author in designing the inflatable space tower [5].

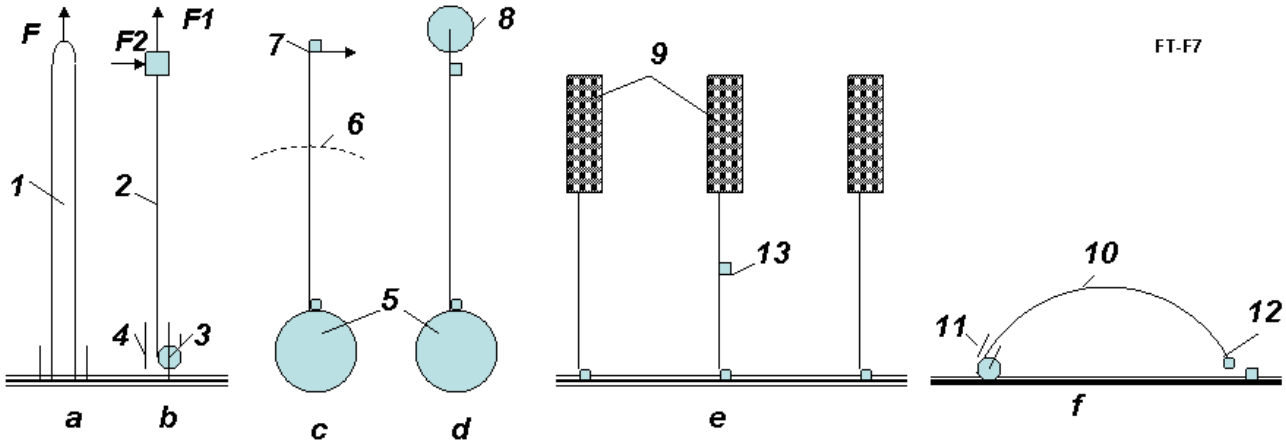

Fig. 7 Applications of AB-needles. *Notations*: *a* – conventional children inflatable long tube illustrated the capability to accept the pressure in end of tube (*F* – force); *b* – illustration of AB-needle to lift the load, accepts the vertical and horizontal forces (*F*1, *F*2 = 0.5*F*1); *c* – AB-needles as the over GSO Space Elevator; *d* – AB-needles as space ship and the investigator of the planet interior (for example Moon); *e* – the building suspended at high altitude by AB – needles, *f* – the investigation of interior of building, men, etc. by AB-needles. 1- conventional children inflatable long tube (air balloon); 2 – AB-needles; 3 – reel of AB-needles; 4 – the guides of AB-needles; 5 – Earth; 6 – Geosynchronous orbit; 7 – space ship; 9 - building; 10 – AB-needle; 11 - the guides of AB-needles; 12 – devices (TV-camera, capture grid, weapon, etc.); 13 – elevator.

The tension F_p activates along all lengths of AB-needle and does not allow to curl the AB-string into the lamb – conventional nucleus. This tension works when there are no other closed protons with a side of the string. When AB-needle is created, the outside protons cannot joint to AB-needle because the protons repel each other. The proton and neutron have the magnetic dipole moments. Magnetic dipole moment of proton equals $+1.41\ 10^{-26}$ J/T, and magnetic dipole moment of neutron equals $-0.966\ 10^{-26}$ J/T. They are small magnets having magnetic force some newtons. That also allows creating the stable AB-needles, to arrange them in a certain position and order. The AB-needle can also keep the maximal side force $F2 \approx 0.5F1$ (Fig. 7b). That allows accelerating anybody (for example space ship) in side direction, to produce an elastic design (for example, air bridge, storage of mechanical energy, long arm (hand), etc.). AB-matter designs do not have the drawbacks of the ordinary matter as fatigue, residual strain and the susceptibility to the external environment.

One meter of AB-needle has line having $n = 5.7 \cdot 10^{-14}$ nucleons with mass $m = 1.67 \cdot 10^{-27}$ kg. Total mass of one meter AB-needle equals only 10^{-12} kg/m.

$$M_1 = nm = 5.7 \cdot 10^{-14} \times 1.67 \cdot 10^{-27} = 10^{-12} \text{ kg/m}.$$

One million kilometers of AB-needle weights only 10^{-3} kg/Mm. For transferring the large force we can take the thin cable from AB-needles.

B. Summary

Three above necessary conditions, repulsive force of protons and magnetic force of nucleons can make the stability of AB-matter.

IV. APPLICATION OF AB-NEEDLES

Some properties of AB-matter are considered in [1] and here. That has a gigantic strength. The maximal tensile stress equals $\sigma_t \approx 8 \cdot 10^{31}$ N/m^2 (nanotubes has only $\sigma_t \approx 2\ 10^{11}$ N/m^2, that is 100 billion times less), high maximal pressure stress of the long stability AB-needle equals about $\sigma_t \approx 7.5\ 10^{30}$ N/m^2, and the safety temperature is millions of degrees. The many applications of super strong AB-matter are shown in [1-6]. The discovery by author the unique property of super thin AB-needle to transfer the pressure in any long distance opens the new gigantic application of AB-needles. Some of these applications are shown below. In our consideration you must remember that nuclear AB-needle in million times is less than the simplest hydrogen molecule. Our AB-needles in this molecule is as conventional rod traveling in solar system. The probability to meet planet, asteroid or meteor in space is very small. The tens of thousands of the artificial wastes are rotating around (near) Earth. The meet with any of them is catastrophe for satellite or space ship or station. Into molecular space the AB-needle can only meet very rare nucleus. But they charged positive as AB-needle and they will move away by electric force from AB-needle.

A. Penetration into Human Body

We can penetrate into the human body by AB-needle (cable from AB-needles) without body damage. We reach any cells of human body. We can design the artificial arm (hand) (Fig. 7f) of the length in hundreds of kilometers, connect to end of arm the femto TV, femto devices, observe and manipulate into human body.

We can work from distance in hundreds of kilometers. The man will not see our artificial arm and not feel that AB-needle penetrates into his body. We can repair or damage his body. Any conventional wall, armor, underground shelter cannot protest him, except special AB-matter (AB-armor).

We can build (work) the home by AB-hand when we locate hundreds or thousands of kilometers from objects.

B. Geological Exploration

Capability of AB-needle to penetrate into any conventional matter is very useful in geology. The AB-needle having the need of femto devices can reach any depth of the Earth (include kernel) and investigate and research them (Fig. 6f). Search for minerals is greatly simplified. You can find oil, gas, water, gold under your house. Moreover, as it will be shown later you can search minerals in other planets, asteroids without space flight, sitting at home. You can research the internal kernel of Sun because the AB-needle can keep the millions of degrees of temperature.

C. Transportation of Any Body

You can take anything by artificial AB-hand in distance hundreds of kilometers away and move to you or any other place.

D. Air Transportation

You can connect any city by air line of AB-needles (Fig. 7f) and delivery loads. This line is not an obstacle for general aviation and matter. They will not see and not feel it. The cars, tracks, and individual men can move along them using the special hook and motor. For people on ground they are flying in the sky. The invisible air bridge through the strait, river, gulf, canyon, and mountain may be built in some minutes.

E. Suspending Houses

The building may be suspended over Earth (include sea, ocean) surface. The invisible, permeable AB-rod will support them (Fig. 7e). They do not damage environment and conventional building because they do not have the house foundation. People have a beautiful view. The humanity can colonize the sea and ocean.

F. Storage of Mechanical Energy

The AB-cable wounded on a microscopic coil is capable of accumulating the gigantic energy and return it as mechanical energy with 100% efficiency. That may be rotation (as spring in old mechanical clock) or a push force as is shown in Fig. 7b.

Estimation of a maximal specific storage energy E_{ms} [N/kg] approximately is

$$E_{ms} = \frac{F_p L}{2M} \quad (3)$$

where L is length of AB-cable, m; M is mass of AB-cable, kg; F_p is maximal safety repulse force of cable, N. For cable *pnpn*… this energy may be about 10^{13} J/kg. Cable may contain thousands of AB-needles. That is millions of time more than energy in explosive TNT. The density of energy may be also very high value up to 10^{21} J/m^3. That is thousand billions of time more than energy density of a rocket fuel.

G. Protection by AB-matter

The AB-net (Figs. 1d, 2a) may be used as filter for the radiation and molecules (matter). It is known, if the length of radiation wave is less than filter cell, the given type of radiation cannot penetrate through this grid. If diameter of molecule is more than filter cell, the molecule cannot penetrate through the given net. The AB-net (grid) may be used for the separation of different matters (gas or liquid), for example: for getting the fresh water from sea water cheaply; for separation of the carbon dioxide from atmosphere, chimneys, car exhaust tubes, oxygen from atmosphere, radioactive dust from atmosphere and water, etc. The AB-net may be used for protection from dangerous nuclear radiation, poisonous gases, and so on. We can create the invisible light wall which will protect us from terrorists.

Below is Table 1 which shows some properties of protection of some AB-nets.

TABLE 1 PROTECTION OF SOME AB-NETS (PNPN…) AND THEIR PROPERTIES

No	Type of radiation or molecules	Size of AB-net sell, m	Mass of AB-net kg/m^2	Max. press stress, N/m	Max. tensile stress, N/m
1	Visible light	10^{-7}	$2\ 10^{-5}$	$3\ 10^{8}$	$3.35\ 10^{9}$
2	Hard X-ray radiation	10^{-12}	2	$3\ 10^{13}$	$3.35\ 10^{14}$
3	Gamma (nuclear) radiation	10^{-13}	20	$3\ 10^{14}$	$3.35\ 10^{15}$
4	Protection from AB-needles	$2\ 10^{-15}$	420	$1.5\ 10^{16}$	$1.6\ 10^{17}$
5	Protection from molecules	$2.7\ 10^{-8}$	$7.4\ 10^{-5}$	$1.11\ 10^{9}$	$1.2\ 10^{10}$

H. AB-needles and Space Flight

The AB-needles (cables) open the gigantic possibilities in the space research and flight.

You can use the AB-hand manipulator (arm) from AB-needs having length of hundreds of millions kilometers and keeping the femto devices in end (Fig. 7d). If mass of devices is 1 – 10 kg, the mass of AB-hand must be 1 – 10 grams for 1 million of kilometers. The distance to Moon is 384,400 km, to Mars 78 millions km (when Mars is closest position, every two years). You can study and research these space bodies (include interior) from your home. Moreover, using the power AB-hand, you can build house on the planet before you will travel to it.

We can lift by AB-cable the loads into space in a distance in thousand km (Figs. 6b, 7b), keep the motionless satellites, and delivery the satellites to other planets. There is no problem to build the Space Elevator including GEO (and over) Space Elevator from Earth surface (Fig. 7c). There is no problem with conventional cable for Space Elevator. Any space garbage, meteorite from conventional matter cannot damage the femto cable because the femto cable penetrates the nano matter.

We can free and quick flight to space in the manner space ships (Fig. 7d). The small spool of AB-cable will accelerate and inhibit the space ships and permanent connection of him to Earth. Below in Table 2 reader finds computation of the time, speed and some other parameters of space flights to planets of solar system by offering AB-space ship.

TABLE 2. COMPUTATION OF SPACE FLIGHT TO SOLAR PLANETS BY MANNER AB-SPACE SHIP. THE ACCELERATION AND INHIBITION HAVE G = 10M/S^2, MASS OF SPACE SHIP IS 3 TONS.

No.	Planet	Distance from Sun 10^{10} km	Distance from Earth 10^{10} km	Flight* time, 10^3 sec	Flight time, Days	Max. speed, km/s	Mass of AB-cable kg
1	Mercury	5.79	9.2	19.2	2.22	1382	184
2	Venus	10.8	4.2	13	1.5	1140	84
3	Earth	15	0	-	-	-	-
4	Mars	22.8	7.8	17.7	2.04	883	154
5	Jupiter	77.8	62.8	50.1	5.8	2239	1356
6	Suturn	142.7	127.7	71.5	8.28	2674	2550
7	Uranus	286.9	281.9	107	12.4	3271	5638
8	Neptune	449.7	434.7	132	15.3	3633	8694
9	Moon	-	0.0384	1.24	0.14	352	0.77
10	Sun	-	15	25.5	3	1597	300

*include inhibition with g = 10 m/s^2.

In any case the safety press force is very high because we can take thousands of AB-needles and push any load (space ship, anybody) or keep them at any altitude.

V. PRODUCTION OF AB-NEEDLES

The charged particles interact with electric and magnetic fields. The magnetic moment interacts with magnetic field. That allows designing the technologies for production of artificial AB-matter. Some offered technologies were described in [1]. Here the author offers some new technologies.

The possible particles are shown in Table 3.

TABLE 3 CHARGE, IMPULSE AND MAGNETIC MOMENTS OF SOME NUCLEUS

Z	Nucleus (particles)	Charge $+e=1.6\ 10^{-19}$ C	Mass number	Impulse moment, $\hbar$	Magnetic* moment, μ_N
0	n	0	1	1/2	-1.9125
1	p	1	1	1/2	2.7828
1	^{2}H = D	1	2	1	0.8565
2	^{3}He	2	3	1/2	-2.121
2	^{4}He	2	4	0	0
3	^{6}Li	3	6	1	0.821
3	^{7}Li	3	7	3/2	3.2332

*Nuclear magnetron $\mu_N = 5.051\ 10^{-27}$ J/T. Sign "-"shows: magnetic moment is opposite the impulse moment.

A. Notes About Possible Form AB-needles

The possible form of AB-needles is shown in Fig. 8.

The first form marked 1 (pppp…) contains only line of protons. This form is cheapest and has maximum pressure strength. But it is unknown whether this form is possible or not. It is known the single hydrogen and single proton are stable. In other side the fusion of two single hydrogen nuclei ^{1}H (protons) produces deuterium ^{2}H= D (*pn*) releasing a positron and a neutrino as one proton changes into a neutron:

$$^1\text{H} + {}^1\text{H} \rightarrow {}^2\text{H} + \underline{e^+} + \underline{\nu_e} + 0.42\ \text{MeV} \qquad (4)$$

The fusion reaction released in this step produces energy up to 0.42 MeV. The most of this energy is taken away by neutrino.

The positron immediately annihilates with an electron, and their mass energy is carried off by two gamma ray photos:

$$e^+ + e^- \rightarrow 2\underline{\gamma} + 1.02\ \text{MeV}\ . \qquad (5)$$

But most nucleuses have a lot of protons and they do not rely on the reaction (4). The AB-needle also has a lot of protons. If reaction (4) is released, the form 1 transfers in form 2 (Fig. 8) and the process produces a lot of nuclear energy. The ionized conventional hydrogen ^{1}H may be used for production of AB-matter. I remain: the Universe is composed of about 80% hydrogen. As a result we will have the AB-needle in form *npnp*… .

The second form of AB-needle is *pnpn*… marked 2 (Fig. 8). This form may be produced directly from deuterium *D* oriented by magnetic field along axis of AB-needles. The third form of the double AB-needles marked 3 (Fig. 8) may be also produced directly from deuterium *D* oriented by magnetic field perpendicular of axis of AB-needles. The forth form of four-needles marked 4 (Fig. 8) may be produced directly from helium ^{4}He oriented by magnetic field perpendicular of axis of AB-needles.

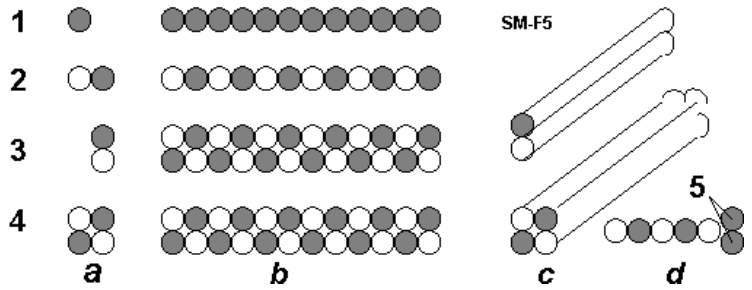

Fig. 8 Types of AB-needles. *Notations*: *a* – Nucleus: black is *p*, white is *n*; *b* – AB-needles (side view); c – AB-needles in isometrical view; *d* – increasing the internal tensile stress by the double protons (5) located in the end of single AB-needle from protons (for increasing the tensile stress); 1- protons (p). Single AB-needles from proton; 2 – deuterium ^{2}H = D (*pn*). Single AB-needles from deuterium; 3 - deuterium ^{2}H (*pn)*. Double AB-needles from deuterium; 4 – helium ^{4}He. 4 – square AB-needles from helium. 5 – double protons in end of single AB-needle.

B. Installations for Production AB-needles

1) The First Method: Toroid Method:

One of installation for production of AB-needles is shown in Fig. 9. The installation has a vacuum topoid 1 and particles gun 4 which injects charged particles into toroid. The perpendicular (to fig.) magnetic lines 2 penetrate the toroid. As a result the charged particles 3 move in circles inside the toroid. This electric current of particles produces the magnetic field 5 (pinch-affect). This field pulls the particles in a cord and helps to keep them into the toroid ring.

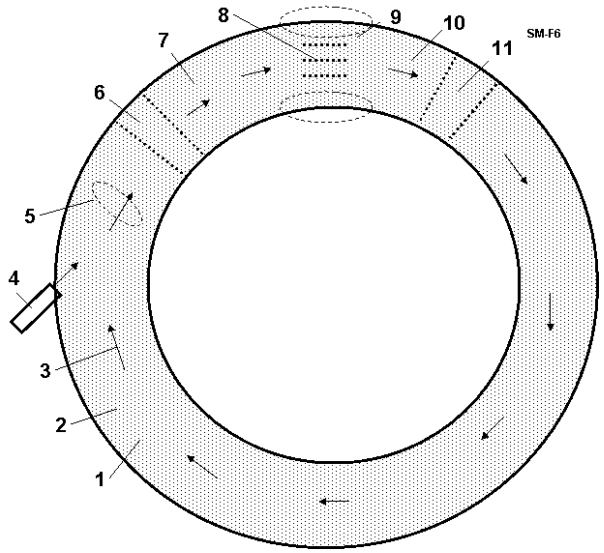

Fig. 9 Toroid producer of AB-needles (AB-matter). *Notations*: 1 – vacuum toroid; 2 – perpendicular (to sketch) magnetic lines; 3 – particles; 4 - particles gun; 5 – round magnetic lines from motion charged particles; 6 – electric accelerator; 7 – electric focuser; 8 – AB – needles; 9 – magnetic field keeping the AB-needles; 10 – electric focuser; 11 – electric accelerator.

The producing AB-needles 8 locate inside the toroid ring and are kept by special local magnetic field 9 in position along the circle axis of the toroid ring. That means the moving particles can connect to AB-needles only to end nucleus when they collide the forward end of AB-needle and their energy is sufficient to overcome the Coulomb repulsion. The toroid ring has the accelerators 6, 11 and focusers 7, 10 of particles. Their electric fields collect the scattered charged particles back to toroid axis.

Probability of hitting in the front end of the AB-needles is small. But the charged particles rotate into toroid a lot (millions) of times and join to end of AB-needles. Note they can connect only to end of AB-needle. Their perpendicular speed to the toroid circle axis is not enough to overcome the nuclear repulsion force.

Author wrote only the principal scheme (schematic diagram) of the AB-needle producing. The developing of this method may request a big research and work.

2) The Second Method: Method Particles Traps:

That is shown in Fig. 10. That is closed to method described in [1]. Feature is the net of traps 8 (Fig. 10a and 10b). They catch the particles and direct them to end of creating AB-needles. Advantage is high efficiency of production AB-matter (every charged particle will be used, small of energy consumption). Lack is the request of a special form of AB-matter (see 8 in Fig. 10b). That method may be useful when we have enough AB-matter.

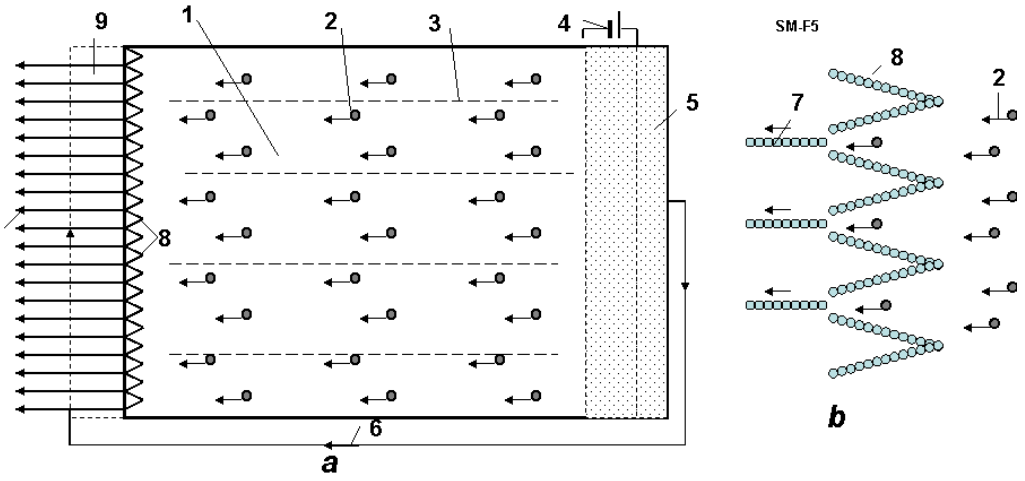

Fig. 10. Method particle traps for production of the AB-needles. *Notations*: *a* – device; *b* – particle traps; 1 - vacuum cell; 2- charged particles; 3 – magnetic lines; 4 – electric issue for the acceleration nets; 5 - plasma from particles; 6 – flow of electrons; 7 – AB-needles; 8 – trap made from AB-matter for the charged particles (*p*, ^{2}H, ^{4}He, etc.); 9 – cell for cover the AB-needles by electrons.

3) The Third Method: Method Standing Waves:

The current special mirrors [4, Ch.12] and lasers allow to create the net of electromagnetic traps for AB-matter producer (Fig. 11) from the monochromatic polarized electromagnetic standing waves (Fig. 11a, b). That net may partially change the net of AB-matter traps of the Fig. 10b and increase the efficiency. This method may be useful for AB-matter producer in [1].

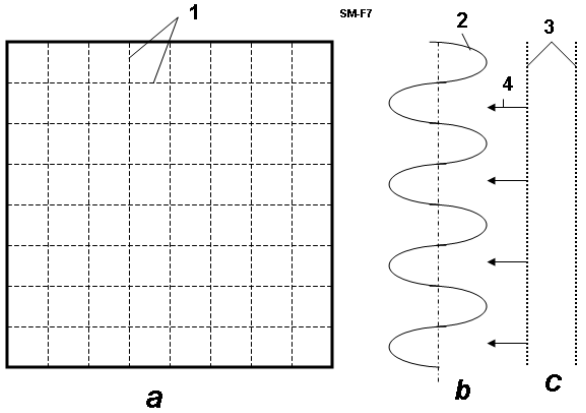

Fig. 11. Net of electromagnetic traps for AB-matter producer. *Notations*: *a* – forward view; *b* – the monochromatic polarized electromagnetic standing waves (electrostatic part, side view); *c* – particles storage and accelerator; 1 – net from the perpendicular monochromatic polarized electromagnetic standing waves; 2 - the electromagnetic monochromatic polarized standing wave; 3 – electric accelerator of particles; 4 – particles.

The threads from AB-matter are stronger by millions of times than normal materials. They can be inserted as reinforcements, into conventional materials, which serve as a matrix, and are thus strengthened by thousands of times (see computation section in [1]).

The offered AB-producers can be used for producing the new NANO-matters. Now the scientist offers to produce nano-matters by nano-robots. I think that is a very difficult way. The nano-robot must have the devices for searching, recognizing, catching the flying molecules, deliver them in given place, and connect to other selected molecules. That means the nano-robot must have a million molecules. It is difficult to get an elephant to catch the flies and glue them from the device. This productivity will be very low. The production of AB-matter may be easy.

Also we can ionize the molecules (create the charged particles!) and apply the modified offered methods for design and production of the nano-matters.

VI. DISCUSSION

The humanity will make a gigantic jump in technology when one will produce AB-matter. We consider unconventional application of AB-matter.

A. Super Micro-World from AB-Matter: An Amusing Thought-Experiment

AB-matter may have $10^{15} \div 10^{43}$ times more particles in a given volume than a single atom. A human being, man made from conventional matter, contains about 5×10^{26} molecules. That means that 'femto-beings' of equal complexity from AB-matter (having same number of components) could be located in the volume of one microbe having size $10\ \mu = 10^{-5}$ m. It is difficult to make the nano-robot (one is large for Nano World). But the smart small femto-robot is suitable for Nano World. In future the people could make the artificial intelligent super micro F-beings which can withstand a huge temperature, acceleration of electric field, travel to other stars, other galactic, live in stars and travel through black holes to other universes and times.

B. Stability of AB-matter

Readers usually ask: the connection (proton to proton) gives a new element when, after 92 protons, this element is unstable?

Answer: That depends entirely on the type of connection. If we conventionally join the carbon atom to another carbon atom a lot of times, we then get the conventional piece of a coal. If we join the carbon atom to another carbon atom by the indicated special forms, we then get the very strong single-wall nanotubes, graphene nano-ribbon (super-thin film), armchair, zigzag, chiral, fullerite, torus, nanobud and other forms of nano-materials. That outcome becomes possible because the atomic force (van der Waals force, named for the Dutch physicist Johannes Diderik van der Waals, 1837-1923, etc.) is non-spherical and active in the short (one molecule) distance. The nucleon nuclear force is also non-spherical and they may also be active about

the one nucleon diameter distance (Fig. 1). Moreover, the nucleus has a tensile electrostatic force which allows designing the long linear structures. Moreover, the proton is a small magnet. The magnets (and nucleus) connect one to other specific side. That means we may also produce with them the strings, tubes, films, nets and other geometrical constructions.

The further studies are shown that AB-matter will be stable if:

1) The any sphere having radius $R \approx 6\times10^{-15}$ m in any point of structure Figs. 1- 4 must contain no more than 238 nucleons (about 92 of them must be protons). That means any cross-section area of the solid rod, beam and so on of AB-structure (for example figs. 1b,c,g) must contain no more than about 36 nucleons in any circle with $R \approx 6\times10^{-15}$ m.

2) AB-matter must contain the proton in a certain order because the electrostatic repel forces of them give the stability of the given structure.

3) The magnetic force of protons also allows giving the different forms of AB-matter.

VII. CONCLUSION

The author offers a design for a new form of nuclear matter from nucleons (neutrons, protons), electrons, and other nuclear particles. He also suggests the necessary conditions of stability of AB-matter. He shows that the new AB-matter has most extraordinary properties (for example, (in varying circumstances) remarkable tensile strength, stiffness, hardness, critical temperature, superconductivity, super-transparency, ghostlike ability to pass through matter, zero friction, etc.), which are millions of times better than corresponded properties of conventional molecular matter. He shows (in [2]) how to design aircraft, ships, transportation, thermonuclear reactors, and constructions, and so on from this new nuclear matter. These vehicles will have correspondingly amazing possibilities (invisibility, passing through any wall and amour, protection from nuclear bombs and any radiation, etc).

People may think this is fantasy. But fifteen years ago most people and many scientists thought nanotechnology is fantasy. Now many groups and industrial labs, even startups, spend hundreds of millions of dollars for development of nanotechnological-range products (precise chemistry, patterned atoms, catalysts, metamaterials, etc) and we have nanotubes (a new material which does not exist in Nature!) and other achievements beginning to come out of the pipeline in prospect. Nanotubes are stronger than steel by a hundred times—surely an amazement to a 19^{th} century observer if he could behold them.

Nanotechnology, in near term prospect, operates with objects (molecules and atoms) having the size in nanometer (10^{-9} m). The author here outlines perhaps more distant operations with objects (nuclei) having size in the femtometer range, (10^{-15} m, millions of times smaller than the nanometer scale). The name of this new technology is femtotechnology.

I want to explain the main thrust of this by analogy. Assume some thousands of years ago we live in a great river valley where there are no stones for building and only poor timber. In nature we notice that there are many types of clay (nuclei of atom—types of element). One man offers to people to make from clay bricks (AB-Matter) and build from these bricks a fantastic array of desirable structures too complex to make from naturally occuring mounds of mud. The bricks enable by increased precision and strength things impossible before. A new level of human civilization begins.

The author calls upon scientists and the technical community to research and develop femtotechnology [10]. We can reach progress more quickly than in the further prospects of nanotechnology in this field, because we have fewer (only 3) initial components (proton, neutron, electron) and interaction between them is well-known (3 main forces: strong, weak, electrostatic). The different conventional atoms number about 100, most common molecules are tens of thousands and interactions between them are very complex (e.g. Van der Waals force).

What time horizon might we face in this quest? The physicist Richard Feynman offered his idea to design artificial matter from atoms and molecules at an American Physical Society meeting at Caltech on December 29, 1959. But only in the last 15 years we have initial progress in nanotechnology. On the other hand, progress is becoming swifter as more and better tools become common and as the technical community grows.

Now we are in the position of trying to progress from the ancient ‘telega’ haywagon of rural Russia (in analogy, conventional matter composites) to a ‘luxury sport coupe’ (advanced tailored nanomaterials). The author suggests we have little to lose and literal worlds to gain by simultaneously researching how to leap from ‘telega’ to ‘hypersonic space plane’. (Femotech materials and technologies, enabling all the wonders outlined here) [1 – 11].

ACKNOWLEDGEMENT

The author wishes to acknowledge Joseph Friedlander (of Shave Shomron, Israel) for correcting the English and offering useful advices and suggestions.

REFERENCES

(The reader may find some of these articles at the author's web page http://www.scribd.com , http://arxiv.org , http://vixra.org, http://aiaa.org , search "Bolonkin" and in the books: "*Non-Rocket Space Launch and Flight*", Elsevier, London, 2005, 488 pages; "*New Concepts, Ideas, Innovations in Aerospace, Technology and Human Science*", NOVA, 2006, 502 pages and "*Macro-Projects: Environment and Technology*", NOVA 2007, 536 pages; "New Technologies and Revolutionary Projects", Scribd, 2008, 324 pgs; Innovations and New Technologies. Scribd, 2013. 309 pgs. 8 Mb.).

[1] Bolonkin A.A., Femtotechnology. Nuclear AB-Matter with Fantastic Properties, *American Journal of Engineering and Applied Sciences.* 2 (2), 2009, p.501-514. Presented as paper AIAA-2009-4620 to 7th Annual International Energy Convention Conference, 2-5 August 2009, Denver, CO, USA. [On line]: http://www.scribd.com/doc/24045154. http://viXra.org/abs/1309.0201 .

[2] Bolonkin A.A., Femtotechnology: Design of the Strongest AB-Matter for Aerospace. Presented as paper AIAA-2009-4620 to 45 Joint Propulsion Conference, 2-5 August, 2009, Denver CO, USA. See also closed paper AIAA-2010-1556 in 48 Aerospace Meeting, New Horizons, 4 – 7 January, 2010, Orlando, FL, USA. http://www.archive.org/details/FemtotechnologyDesignOfTheStrongestAb-matterForAerospace . Published in "Journal of Aerospace Engineering", Oct. 2010, Vol. 23, No. 4, pp.281-292. http://www.archive.org/details/FemtotechnologyDesignOfTheStrongestAb-matterForAerospace http://www.scribd.com/doc/57369206/Femtotechnology-Design-of-the-Strongest-AB-Matter-for-Aerospace

[3] Bolonkin A.A., Converting of Matter to Nuclear Energy by AB-Generator. *American Journal of Engineering and Applied Sciences.* 2 (4), 2009, p.683-693. [on line] http://www.scribd.com/doc/24048466. http://viXra.org/abs/1309.0200

[4] Bolonkin A.A., Converting of any Matter to Nuclear Energy by AB-Generator and Aerospace. Journal of Energy Storige and Conversion, Vol.3, #1, January-June 2012, p. 43-69. http://www.archive.org/details/ConvertingOfAnyMatterToNuclearEnergyByAb-generatorAndAerospace http://www.scribd.com/doc/57419950/Converting-of-Matter-to-Nuclear-Energy-by-AB-Generator-and-its-Application

[5] Bolonkin A.A., "Non-Rocket Space Launch and Flight", Elsevier, 2005, 488 pgs. ISBN-13: 978-0-08044-731- 5, ISBN-10: 0-080-44731-7 . http://www.archive.org/details/Non-rocketSpaceLaunchAndFlight, http://www.scribd.com/doc/24056182.

[6] Bolonkin A.A., "New Concepts, Ideas, Innovations in Aerospace, Technology and the Human Sciences", NOVA, 2006, 510 pgs. ISBN-13:978-1-60021-787-6.http://www.scribd.com/doc/24057071 , http://www.archive.org/details/NewConceptsIfeasAndInnovationsInAerospaceTechnologyAndHumanSciences, http://viXra.org/abs/1309.0193,

[7] Bolonkin A.A., Cathcart R.B., "Macro-Projects: Environments and Technologies**",** NOVA, 2007, 536 pgs. ISBN 978-1-60456-998-8. http://www.scribd.com/doc/24057930 . http://viXra.org/abs/1309.0192 , http://www.archive.org/details/Macro-projectsEnvironmentsAndTechnologies

[8] Bolonkin A.A., "New Technologies and Revolutionary Projects", Scribd, 2008, 324 pgs, http://www.scribd.com/doc/32744477, http://www.archive.org/details/NewTechnologiesAndRevolutionaryProjects.

[9] Bolonkin A.A., LIFE. SCIENCE. FUTURE (Biography notes, researches and innovations). Lambert, 2010, 208 pgs. 16 Mb. ISBN: 978-3-8473-0839-3 **.** http://www.scribd.com/doc/48229884, http://www.archive.org/details/Life.Science.Future.biographyNotesResearchesAndInnovations, http://viXra.org/abs/1309.0205 , http://www.lulu.com, search "Bolonkin".

[10] Bolonkin A.A., Femtotechnologies and Revolutionary Projects**.** Lambert, USA, 2011. 538 p. 16 Mb. ISBN: 978-3-8473-0839-0. http://www.scribd.com/doc/75519828/, http://viXra.org/abs/1309.0191, http://www.archive.org/details/FemtotechnologiesAndRevolutionaryProjects .

[11] http://www.physicum.narod,ru, Vol. 5., p.670.

Short biography of Bolonkin, Alexander Alexandrovich (1933-)

Alexander A. Bolonkin was born in the former USSR. He holds doctoral degree in aviation engineering from Moscow Aviation Institute and a post-doctoral degree in aerospace engineering from Leningrad Polytechnic University. He has held the positions of senior engineer in the Antonov Aircraft Design Company and Chairman of the Reliability Department in the Clushko Rocket Design Company. He has also lectured at the Moscow Aviation Universities. Following his arrival in the United States in 1988, he lectured at the New Jersey Institute of Technology and worked as a Senior Scientist at NASA and the US Air Force Research Laboratories.

Bolonkin is the author of more than 200 scientific articles and books and has 17 inventions to his credit. His most notable books include The Development of Soviet Rocket Engines (Delphic Ass., Inc., Washington , 1991); Non-Rocket Space Launch and Flight (Elsevier, 2006); New Concepts, Ideas, Innovation in Aerospace, Technology and Human Life (NOVA, 2007); Macro-Projects: Environment and Technology (NOVA, 2008 LIFE; Human Immortality and Electronic Civilization, 3-rd Edition, (Lulu, 2007; Publish America, 2010): LIFE. SCIENCE. FUTURE (Biography notes, researches and innovations). Scribd, 2010, 208 pgs. 16 Mb. http://www.scribd.com/doc/48229884 ; Innovations and New Technologies. Scribd, 2013. 309 pgs. 8 Mb. http://viXra.org/abs/1307.0169.

Home page: http://Bolonkin.narod.ru .