Topic related to a theme of the 12th Rhodes Forum Agenda
- Projects fostering solidarity in the fields of economic development and regional cooperation and integration;

A Vision for the Future

Peace through Development: a true Dialogue of Cultures

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"Where there is no vision, the people perish"
Proverbs 29, 18

"Man has never accepted his limitations for long. His 'impossible' dreams and ideals, his defiant refusal to be subordinated to his environment, and his reaching for the 'unreachable' are integral parts of his nature, the maintenance of which is no less important than that of his natural environment. In processes of constant renewal, man fulfills himself through cultural and civilizational recreation and by extending his environment." - Krafft Ehricke – Raumfahrtziele und Weltraumtechnik von Morgen

The creation of solidarity, collaboration and integration among nations today will only be possible by giving mankind and our individual nations a vision for the future which in turn requires solidarity, collaboration and integration sine qua non. Once you know where you want to go, you may decide which way to take. If we define a vision of a future in which nations collaborate in friendship, we will have to create a durable peace. Such a peace in turn requires all participants to cooperate and to better understand each other.

Major projects between nations are particularly appropriate here, especially when they are aimed at breaking through known boundaries in science, production, technology, physics etc. Achieving conceptional breakthroughs and realizing such projects is possible only through a dialogue on various levels. Each nation can draw on its own history's great achievements to contribute to this dialogue.

It is this character which distinguished truly great projects in the past. Both, the development of space exploration and the discovery and realization of nuclear fission technology, stand as historical proof of that fact. Both efforts involved representatives of several cultures. A closer look will easily reveal that their different cultural and national backgrounds were by no means a disadvantage; on the contrary, this diversity of approaches and backgrounds facilitated solutions to the given problems. The *Apollo Project* as well as the USSR's own *Vostok Project*, and also the harmonious collaboration of the group around Albert Einstein, Max Planck, Lise Meitner, Otto Hahn, Marie and Pierre Curie and Vladimir I. Vernadsky in discovering and exploring the subatomic region, make this point clear.

The successes of such limited collaboration best prove the advantages of an international dialogue of cultures and the collaboration of entire nations on a larger scale.

"For culture to blossom there is needed, first of all, a certain degree of prosperity which enables a fraction of the population to work at things not directly necessary to the maintenance of life; second, a moral tradition of respect for cultural values and achievements, in virtue of which this class is provided with the means of living by the other classes, those who provide the immediate necessities of life."

"During the past century Germany has been one of the countries in which both conditions were fulfilled. The prosperity was, taken as a whole, modest but sufficient; the tradition of respect for culture, vigorous. On this basis the German nation has brought forth fruits of culture which form an integral part of the development of the modern world." — Albert Einstein, Culture & Prosperity

Those two key areas named above — nuclear physics and space exploration — can play a decisive role today in defining a vision for the future. Major projects, premised on a dialogue of cultures, create a durable peace through economic

reconstruction, scientific development and cultural dialogue, in which solidarity, collaboration and integration of people and nations are the normal condition.

Nuclear Fusion

After the successful mastery of nuclear fission, the "4th generation" initiative created 6 types of reactors which render future Chernobyl or Fukushima scenarios impossible. While disposal of nuclear materials is no longer a problem, the path is cleared for the next step toward mastery of subatomic space. This next step is the application of nuclear fusion on a broad economic platform, with not just ITER playing a major role, but also approaches to nuclear fusion like multi-mirror linear traps, laser fusion, fusor (inertial electric confinement) and hybrid reactors.

Man is the only continually self-developing living species. This quality unique to mankind is expressed in mankind's utilization of ever growing energy-flux densities. Mankind's process of development included the use of wood, coal, coke, oil and gas to the first steps of nuclear fission as power-sources of ever higher energy-flux densities.

Each step in this series of developments opened up new possibilities and new paths of action once the available higher energy-flux density was permitted to affect society in its entirety. Once that happened, higher economic platforms were developed, characterized by new degrees of efficiency in machinery, new knowledge, a better understanding of processes in nature, a higher standard of living etc. Such accomplishments are achieved much better in collaboration than in mutually isolated efforts. In the past, the possibility for such collaboration was often limited for a number of reasons, but today the world is open for us: if we decide to do it, we could create a program of international and regional collaboration to realize nuclear fusion in a crash program much like the US Apollo Program.

What is nuclear fusion all about after all?

Nuclear fusion is the power which drives the sun. The process of fusing nuclei releases immense amounts of energy. This is all the more astonishing if you keep in mind that an atom is already very small, but the nucleus, which nuclear fusion is all about, is an even smaller part of the atom. The size-ratio between a nucleus and an atom is comparable to the difference between a pea and a soccer stadium. This begs the questions how it is even possible for such a small object to unfold such powerful forces as those driving the sun?

On the basis of their research into the smallest known parts of matter, Max Planck and Albert Einstein, formulated their ideas about subatomic space; one of the first discoveries was that the atom was not one whole particle, and that most of the atom appeared to be empty space. The atom as we know it now, with its orbiting electrons and its nucleus at the center, appears rather like a very small solar system than one solid particle. As with the solar system, most of the space between its component parts is indeed "empty" space.

The fact that in this microscopic domain the universe works fundamentally differently than our experience teaches us about the macrocosm is even more interesting. The seeming interaction of smallest particles and the coherence of atoms can neither be caused by gravitational forces as we know them, nor by known electromagnetic phenomena. It must therefore either be an entirely different power or a yet unknown effect of a known power created by interacting, multiply dynamic forces. There is much about this bond which we don't understand yet, but we do know that splitting the atom's nucleus and dissolving that bond, releases enormous amounts of energy. This process is called nuclear fission. The process of joining nuclei is called nuclear fusion. Compared to nuclear fission, nuclear fusion releases much more energy. This results from the higher energy-flux density of the nuclear fusion process, which, once its power is harnessed for our human society, will enable us to leap to a higher economic platform. Thus, nuclear fusion will serve as a stepping stone to a qualitatively much higher level of productivity. Only the high energy-flux density of nuclear fusion will permit our society to be lifted to a higher platform, to begin to rebuild the nations of the world.

To achieve this goal as rapidly as possible, we need to initiate a crash program to realize nuclear fusion. Such a crash program could build on and effectively improve already existing fusion research and development in a number of nations. In this effort, we can employ already existing structures for cooperation and integration, both national and regional. One such structure for a necessary European fusion crash program is the already existing roadmap of EFDA (European Fusion Development Agreement) which today proposes a program aimed supplying fusion power from ITER-type reactors to the power grid by 2050. EFDA is already established internationally with 28 nations collaborating in Europe. What is still lacking is for this roadmap to become an actual crash program. That in turn would require all participating nations to make nuclear fusion a national priority, and to generate sufficient productive credit to make sure that *everything* is done for a speedy implementation of the program.

Furthermore, such a program will have to take into account the 28 European nations' regional differences in economic, technological and scientific development, which need to be overcome to enable those nations to build up their nuclear fusion capabilities. A growing number of efficient and independent national fusion programs would thus be created, which in turn would collaborate and stimulate dialogue between regions and nations. Only various independent fusion programs, in pursuing different avenues towards achieving fusion, would make this dialogue fruitful. This would stand in stark contrast to today's approach of a very limited number of fusion research programs and contributing elements that are not able to take independent, new approaches. This limits the possibilities for new scientific and technological discoveries and a real dialogue between the various institutions is thereby inhibited.

Taking this into account, the realistic goal of such a crash program would be to achieve nuclear fusion in 10-20 years, all the while technologies already exist which could potentially connect nuclear fusion power to the power grid in 5-10 years.

To achieve that, the individual nations need to recognize nuclear fusion as a priority and concentrate all their efforts on that mission. This means a massive increase of investment in all areas of research and production associated with the nuclear fusion program, the development of relevant educational facilities, the creation of information programs at schools and universities, and the integration of all important fusion centers into a European fusion infrastructure without eliminating national capacities.

In this way, nations and regions of Europa can actually grow together, as shared visions and projects create collaboration beyond mere administrative structures. The following sketch shall demonstrate what this collaboration in Europe could look like.

A Manhattan Project for Central Europe

A number of large research institutions already exist in the larger region of **Austria, Switzerland, Germany, France, Luxembourg, Belgium, the Netherlands, Great Britain** and **Ireland**, which in an Apollo or Manhattan Project style crash program could immediately take important steps. Invigorating their national economies, economic centers and the necessary infrastructure, would quickly lead these countries on the path towards nuclear fusion. To solve one remaining problem, the lack of a skilled labor force in areas relevant to nuclear fusion, an educational initiative must begin simultaneously at schools, to inspire the students to join the work on such a project. This would also require restructuring many parts of the educational system.

Pioneer of laser fusion, Jean Robieux, wrote on in *Towards the End of Global Warming: Laser Nuclear Fusion*:

"Supposing that a high school had chosen to specialize in — energy studies — for example.
The teaching team would be led by physics teacher for whom I personally have the greatest admiration for their dedication and skill. They would manage a team made up of highly competent engineers and technicians who would be happy to put their experience to use in helping young people, often on a voluntary basis.[...]"

"This multidisciplinary teaching teams would enable our young people to have a better idea of their capacities and help them choose their career. High school students could thus study in a friendly and interesting atmosphere; they would be better prepared to face the harsh competition awaiting them in the near future." [...]

"Education based on such a system of co-operation and in-depth learning is a force for social mobility. This is why I insist of the fact that our youngsters must have access to an education which is flexible and heartfelt. A dose of imagination needs to be injected into our high school for this will lead to the capacities for innovation indispensable for the benefit of all."

Science Cities

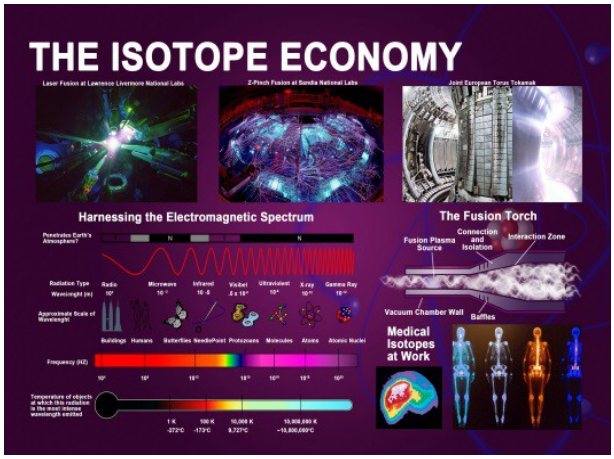
Bulgaria, Hungary, Czech Republic, Poland, Romania, Slovakia, Slovenia: this situation is different in the Southern and Eastern parts of Europe. The above said applies here as well, but in addition there needs to be a focus on the development of efficient facilities and locations in order to prevent a brain-drain from those regions of Europe into a faster developing Western Europe. If certain European fusion research centers were to develop quickly and while others take longer, scientists and engineers might be leaving those less developed regions, thus weakening already weaker countries. This must be prevented by developing the countries to similar levels of infrastructure and technology.

One approach to accomplish that could be the development of science cities modeled on the Japanese science cities Tsukuba and Kansai; Ulm's Oberer Eselsberg could also serve as a model science city. Mistakes of the past, such as a lack of cultural facilities and also living quarters within those cities, should be avoided in this new effort.

"The Science City shall be developed in such a way as to make it possible for institutions to carry out high-level research and educational activities by maintaining mutual organic connections, while at the same time, the preservation of the natural environment and historical heritage shall be promoted so that the new Science City may be planned in such a way as to enable the residents to maintain a wholesome and cultural living." — Academic New Town Construction Promotion Headquarters, 1971

Greece, Cyprus, Italy, Spain, Portugal, Malta: A similar approach applies in Southern Europe, but because of the currently ongoing economic and social destruction, development should begin with smaller science centers — as in Germany, Singapore, Hong Kong and Malaysia – which then would be developed into cities, to quickly develop these countries to the same level.

Estonia, Lithuania, Latvia – Denmark, Sweden, Finland: A combination of the steps discussed above could be developed into a program for the Baltic sea region, bringing Northern and Eastern Europe into close collaboration. On the path towards a global fusion economy, the Scandinavian countries with their developed capacities in fine electronics and machine tool design could provide unique assistance to the baltic republics of Estonia, Lithuania and Latvia.



Technology

Using a crash program to bring all nations and regional groups of nations to the same level is all the more important, because, as was mentioned above, the task is not only to develop fusion power via the ITER project, but rather to explore all other existing possibilities of nuclear fusion.

Besides the ITER tokamak conception, other technological avenues like laser fusion, cold fusion, energy-focus technology (Z machine) and fusor must be scrutinized. The potential for change lies not merely in developing fusion power as a source of electrical energy, but rather in the full-scale application of an

entirely new physical principal using higher energy-flux densities. It is therefore imperative to follow up on all other approaches as well, since they promise entirely new insights and discoveries and the potential to change our understanding of physics as such, which in turn unfolds new potentials and new possible applications.

Nuclear Fusion: Energy for Space

The most recent initiative to break completely new frontiers for mankind has been taken by the Chinese program to mine He^3 on the moon, which would create a true scientific revolution both for fusion and space exploration. Of the many possible applications of nuclear fusion based technologies, space exploration is the most interesting, because it would continue and extend what we have already discussed about nuclear fusion in combination with the principles of collaboration, solidarity and integration.

If mankind is to conquer space, nuclear fusion will be indispensable. With nuclear fusion mankind has at its disposal an inexhaustible source of power at densities which will enable mankind to travel in the solar system. It gives us the opportunity of constant acceleration with a thrust of 1G, creating the artificial effect of earth gravity. It also gives us the possibility to create a magnetic field, simulating the electromagnetic environment of earth abroad a spaceship or a space station, providing protection from harmful outer influences.

A multitude of technological possibilities and their realization, and energy in abundance, would create many new branches of science; already existing ones as biology, chemistry, materials research and physics would experience an enormous boost, further driving breakthroughs in the above mentioned areas. Fusion would also be a sufficient energy source to conduct every conceivable experiment in space, starting with plant breeding in space under various conditions all the way to exploring the effects of relativistic speeds.

The possibilities of using nuclear futons here on earth to desalinate large amounts of sea water, of using the fusion torch to create unlimited supplies of raw materials or the further use of fusion in the medical field cannot be discussed here at this point. This much shall be said: the common good and the conditions of life for mankind will be advanced through this new platform of nuclear fusion.

By overcoming the limitation of current energy-flux densities, we as a species can develop our creative “play drive” (Spieltrieb) as Friedrich Schiller called it and thus create the long-term conditions for further developing civilization — and our universe.

Concluding Remark

With a few modifications, the example given for Europe could be applied to other regions and thus create the basis for a growing international network. Besides nuclear fusion and the broad field of space travel and exploration there are other key projects like major infrastructure projects, which would create effects similar to those discussed here. However, all of this requires to again begin to define visions for a future, and to understand that creativity, peace and dialogue are necessary to realize them.

Thanks you!

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