

## **22<sup>nd</sup> IAEA Fusion Energy Conference**

**Geneva, 13-18 October 2008**

### **Opening Address by Mr. Yury A. Sokolov**

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October 13, 2008

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Ladies and Gentlemen,

Let me welcome all to this 22<sup>nd</sup> Fusion Energy Conference organized by the International Atomic Energy Agency here in Geneva, which marks the 50th anniversary of international efforts in nuclear fusion research. In one sentence I have summarized all the distinctive features of this event: Geneva, IAEA, fusion research, and international cooperation.

The birth of nuclear power is usually considered to be the discovery of nuclear fission in 1939, although fusion of light nuclei was first observed by Mark Oliphant in 1932. And throughout the long history of fission and fusion, both have supported and challenged each other. Fission first generated electricity in 1951 in the USA and first delivered nuclear electricity to a grid in 1954 in the USSR. Fusion, on the other hand, is still a topic of research with the biggest investments yet to come.

After the World War II, nuclear power benefitted from a new international openness, triggered most substantially by a United Nations conference in 1955 known as “The First Geneva Conference”. It was the largest gathering of scientists and engineers up to that time and confirmed that numerous uses of nuclear energy were feasible, including fusion. The Chairman of the Conference Mr. H. Bahba, whose 100 birthday will be celebrated worldwide in 2009, said that “a method of controlled release of energy of nuclear fusion would be discovered in the next 20 years.” In some sense, this is true. Within twenty years, the controlled confinement of 1 keV plasma in tokamaks, with a corresponding yield of neutrons, was demonstrated.

In response to the deep fears and great expectations resulting from the discovery of nuclear energy, the IAEA was created fifty four years ago, in 1954. Its objective is “to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity”. Nuclear power has been part of the agenda from the start and is now one of the most important subjects in the IAEA’s programme.

In September 1958 a second Geneva Conference drew five thousand delegates and over 2150 submitted papers. National research on fusion in many countries was declassified, following Academician Kurchatov's lecture at Harwell, UK in 1956. Hence, the 1958 Conference is considered as the first world fusion conference, and thus we mark today the 50th anniversary. Sigvard Eklund, who a few years later would succeed Stirling Cole as the Director General of the IAEA, served as the Conference's Secretary General.

The conference was a "fair of ideas". The "star" was L. Spitzer's stellarator. Soviet physicists discussed research with American physicists and there was declassified scientific driven communication among experts from 46 participating countries.

Pioneers of the 1958 conference are here today. Some contributed to a small IAEA brochure as a historic retrospective and some are active in research now. Let me highlight one example, a topic of disruptive instabilities was presented in 1958 by a young Russian woman. She published two papers on this topic during that conference. This year we welcome her to the anniversary conference, which includes her paper on "Tokamak Plasma Self-Organization and Possibility to Have the Peaked Density Profile in ITER". I would like to thank Mrs Razumova as one of the pioneers who has been active in research for all these years, and as someone who contributed substantially to nurturing many generations of Russian fusion scientists and, on a personal note, as my first mentor in fusion research in Kurchatov Institute.

After the Second Geneva Conference the IAEA began convening smaller conferences on specialized nuclear topics like fusion. The conferences' emphasis has always been on scientific quality, which is why fusion always remained young in the IAEA. The IAEA's International Conferences on Plasma Physics and Controlled Nuclear Fusion Research in Salzburg, Culham, Novosibirsk, Madison, Wisconsin, and other locations, in parallel with the enormous efforts of plasma physicists both on research and on promoting open exchanges, have built broad international cooperation. These efforts led to cooperative international activities (in the USA, Japan, the EC and the Soviet Union) to develop a conceptual design for the fusion reactor INTOR. Subsequently, these four countries took the lead in launching ITER (the International Thermonuclear Experimental Reactor). In November 1987, Hans Blix, the Director General of the IAEA, invited the European Community, Japan, the USSR and the USA to prepare the conceptual design of the next large scientific/engineering fusion facility under the auspices of the IAEA. The so-called ITER office in the IAEA started its work in 1988.

The journal *Nuclear Fusion*, published by the IAEA initially quarterly, started in October 1960. In 1978 it became a monthly publication, and is now published online.

The International Fusion Research Council has advised the IAEA since 1972. It puts forward new issues to be handled by the IAEA, and the International Tokamak Physics Activities (ITPA) was developed under its auspices.

The IAEA's role is principally to encourage the exchange of information on nuclear technology research, provide advice, promote training, evaluate nuclear projects and carry out feasibility studies.

But even without direct involvement in projects, the IAEA can play an important role. ITER is a good example. The Agency and Directors General Dr. Hans Blix and Dr.

Mohamed El Baradei played key roles as mediators on crucial occasions in ITER's history. The IAEA has helped consolidate the international fusion community, focusing its plasma physics research on the needs of ITER design, making this research more results oriented and very effectively encouraging worldwide investments in fusion. ITER is a hugely visible example of how big international projects can be organized and how the IAEA can position itself in such projects.

Significant progress has also been made in using both laser power and radiation in inertial confinement. Large new facilities are under construction such as the National Ignition Facility (NIF, USA), the Laser Megajoule Project (LMJ, France), and FIREX I and II (Japan). The new HiPER project (European High Power laser Energy Research facility) was launched at the start of this month.

The IAEA also offers a forum for medium size and small projects. And quite often the smallest projects can influence fusion research a lot. About 44 countries will present their results during this conference; about 70 countries nominated experts to attend the conference.

Many milestones have been achieved since 1958. It is time to thank the fusion pioneers for their excellent work; it is time to thank all scientists, engineers and staff involved in all these experiments since 1958.

The fusion community is still young and is driving new science and new results. It is time to look ahead. The Agency will help to assemble the best human resources, to coordinate fusion and fission studies, to assist in education and training of the next generation, to prepare joint publications and to organize conferences.

I would also like to thank the Swiss Confederation and the UN office in Geneva, for making it possible to return after 50 years to this historic location, the Palais de Nations, here in Geneva.

I personally would like to thank all of you who are part of these conferences and who contribute to the fusion community's work, and I encourage you to stay young and innovative.