INTERVIEW

Iran Will Contribute to the International Thermonuclear Fusion Experiment

by Marsha Freeman

Editorial Note: *The following interview with Dr. Mahmood Ghoranneviss is printed here, not only due to the importance of what Dr. Ghoranneviss reports, as pregnant with potential as that report is, but also for the reader to perceive the significance of Iran's entry into a leading role for fusion energy research, within the greater context of the history-changing developments which are now taking hold within the entirety of Southwest Asia and the extended region of the "Middle East" in general.*

Beginning with the Aug. 8 summit meeting of Russian President Vladimir Putin, the President of Iran, Hassan Rouhani, and the President of Azerbaijan, Ilham Aliyev, and continuing with the meeting between Russian President Putin and Turkish President Recep Tayyip Erdogan on Aug. 9 in St. Petersburg, a change in the entire course of human history and a pathway out of the current global crisis has now been opened up. An effective strategy against terrorism, an attainable perspective for peace, and rapidly expanding potentials for economic development are now all achievable goals. The Putin-Rouhani discussions concerning the development of the North-South Transport Corridor, together with the ever-more determined efforts by the Chinese government to extend a policy of economic development through its "One Belt One Road" initiative, have now made clear how close a new global human potential is to fruition.

It is precisely this perspective for global economic development which Lyndon LaRouche has championed since 1975, and it is the proposal for Eurasian economic development which he presented at a seminar in Washington, D.C. in 1997.

It is within that context that EIR *is most grateful and happy to present the following interview, which among other things, demonstrates Iran's determination to play a leading role in the new Scientific Renaissance.*

—the Editors of EIR

Interview with Dr. Mahmood Ghoranneviss

"Politicians have programs just for less than four years, but great people have programs for their grandchildren."

—Dr. Mahmood Ghoranneviss

Dr. Ghoranneviss, Dean of the Plasma Physics Research Center of the Science & Research Branch of the Islamic Azad University in Iran.

Last year's nuclear agreement between Iran and the P5+1 nations of China, France, Germany, Russia, the United Kingdom, and the United States, created the possibility for Iran to participate in the world's leading fusion experiment, the International Thermonuclear Experimental Reactor, (ITER), which is under construction in France. Iran is well placed to contribute to this worldwide research project, as it has had an active program in fusion research since 1975, and in 1994, established the Plasma Physics Research Center of the Science & Research Branch of the Islamic Azad University, northwest of Tehran. Dr. Mahmood Ghoranneviss is the founder, and current Dean, of the Center. He is also now Iran's official representative to ITER.

In an interview published in the Sept. 18, 2015 issue of *EIR*, Dr. Ghoranneviss described the fusion research activities underway in Iran, and provided photographs of Iran's IR-T1 tokamak. He expressed the expectation on the part of Iran's fusion scientists that Iran could make significant contributions to the global fusion

Plasma Physics Research Center/Islamic Azad University

Iran's IR-T1 tokamak, shown here in 1985, contributes to global fusion research under the small tokamaks program of the International Atomic Energy Agency.

effort. Through a series of recent meetings and discussions, Iran's role in ITER is being defined, and activities are underway to bring Iran into the mainstream of international fusion research. On Aug. 16, Dr. Ghoranneviss provided answers to questions concerning these recent developments, posed to him by *EIR* Technology Editor Marsha Freeman.

EIR: When did the discussions begin on Iran's collaboration on ITER?

Ghoranneviss: As you know, in the P5+1 agreement, one of the points is that Iran can participate in the ITER project. For the past four years, the Plasma Physics Research Center (PPRC) has already been on the list of countries that are active in fusion research, and Iran's PPRC has one of the active tokamaks in the Middle East. There are two tokamaks in Pakistan, and one in Egypt.

On Aug. 28, 2015, just one month after the nuclear agreement was signed, the Director-General of ITER, Dr. Bernard Bigot, suggested collaboration between the PPRC and ITER. I accepted his suggestion, and the necessary steps were taken toward this collaboration. Dr. Bigot said that for full cooperation in this project, we would ultimately need the agreement of the ITER members (Europe, Russia, the USA, China, South Korea, Japan, and India). Hopefully, in the future, the above countries will accept Iran as a participant in the ITER project as one of the main members. It is also possible to be an associate member of ITER.

Dr. Bigot asked me to get formal approval for cooperation from Iran's government. Iran has a long history of research in fusion, and because fusion nuclear energy is a clean energy source, Iran's government was interested in joining ITER. Therefore, as a consultant to Dr. Sorena Sattari, who is the Iranian Vice-President for Science and Technology, I discussed this matter with him. He proposed to get the government's approval, and fortunately he succeeded in two days. We then sent the formal acceptance letter to join the ITER project to Dr. Bigot. I was selected as Iran's representative for the ITER project by Dr. Sattari and Dr. Ali Akbar Salehi, the head of the Atomic Energy Organization of Iran.

EIR: When was the first formal meeting of scientists from Iran with ITER representatives?

Ghoranneviss: Our first meeting was in Vienna, in February 2016. In this meeting, I presented Iran's fusion research activities and Dr. Bigot presented the ITER project's activities. There were five people at the meeting from Iran and four people from the ITER project, and one person from the International Atomic Energy Agency, which is headquartered in Vienna.

EIR: What were the options for Iran that were presented by Dr. Bigot at that meeting?

Ghoranneviss: Dr. Bigot discussed the membership conditions and suggested that Iran can be either an associate member or a main member of ITER. He mentioned, however, that 40% of the project is already done, and major components, such as superconductors and other parts, have already been built by the seven partner countries and have been transferred to France. Each member has expended 1.2 billion euros for its contribution to building ITER. Therefore, if we were to become a main member, we would have to pay the same amount over 10 years.

EIR: What are the requirements that Iran would have to meet to become an associate member?

Ghoranneviss: To become an associate member,

ITER

The Iranian delegation visiting ITER on July 1. From left: Dr. Bernard Bigot, Director-General of ITER; Dr. Ali Akbar Salehi, head of the Atomic Energy Organization of Iran; Dr. Sorena Sattari, Iranian Vice President for Science and Technology; Dr. Ghoranneviss.

one requirement is to educate Masters and PhD students in the nuclear fusion research field in Iran, and later to join one of the more developed and active tokamaks, such as France's Tore Supra superconducting tokamak experiment, which has been upgraded and is now known as WEST. Later, we could join the ITER project. Since the PPRC has been working on diagnostic instruments for its own tokamak, creating their design and construction, ITER presented us with a list of diagnostics, from which to choose for development for ITER. We have chosen some to develop, from those that were suggested to us.

EIR: What meeting followed that first one in Vienna?

Ghoranneviss: At our next meeting, which was held in France, Dr. Sattari and Dr. Salehi and I attended, with some other scientists from Iran. We visited the French Atomic Energy Commission, CEA, and the details of Tore Supra activities were discussed. It was decided to first build a small superconducting tokamak in Iran, with the help of world scientists, along with the ITER project. Then, after the design and construction of diagnostics to make plasma measurements, and after all the parts had been checked, they would be transferred to the ITER project.

The second part of our meeting in France was held in Cadarache at the ITER site. Dr. Salehi suggested that it would be better for Iran to become an associate member of ITER for two years, and later join the project as an 8th full member. This suggestion was accepted by Dr. Bigot and his colleagues. Now, I am gathering both theoretical and experimental experts to develop the diagnostics.

EIR: Has there been follow-up from your visit to France?

Ghoranneviss: After coming back from France in late June, Dr. Salehi invited four scientists from the Atomic Energy Commission of France to visit the PPRC, the Atomic Energy Organization of Iran, and some state universities. The French scientists presented reports on their research activities at the meeting. We expect to sign a contract with CEA France and the ITER project soon.

By the way, the Iran superconducting tokamak (Iran-SC-Tokamak) must be a high-tech tokamak, for operation in 2025-2027. It must develop additional innovations to help ITER and the planning of the post-ITER next-step fusion demonstration reactor, DEMO. Iran is making a huge investment in fusion experiments and also in human resources. So, the international community should participate in this investment for a common purpose, which is DEMO!

EIR: So the plan is to proceed in the near term with the very advanced superconducting tokamak, as an associate member of ITER, and consider full membership later on?

Ghoranneviss: If the goal of Iran is to construct a superconducting tokamak, which will be similar to, but a bit more advanced with respect to South Korea's KSTAR or Europe's WEST experiment, by that time, ITER members will invite Iran to become a main member with honor. To accomplish this requires great determination and needs a serious commitment by Iran for this long-term program. Now is the time for Iran to increase the quality, not the quantity of its fusion research!

EIR: What is the next step?

Ghoranneviss: First, we must prepare a meeting in Tehran and invite the experts and scientists from ITER member countries and others to several forums. Of course, we must also create an Iranian domestic agency to directly interface with the ITER organization.

And then, we need to establish an international scientific committee to determine the critical issues for ITER/DEMO in order to plan for the construction of the new Iranian tokamak with new innovations, not only for Iran, but also for all international users. I believe that Iran must receive about 30% of the costs of the Iran-SC-Tokamak from the international community. This is just my opinion.

Developing fusion energy is a long-term program. The politicians have programs just for less than four years, but the great people have programs for their grandchildren.

ITER

The first major components for ITER began arriving on the construction site in December 2015. It will be, by far, the largest tokamak in the world, designed to produce 500 MW of fusion energy.

Diagnostics

This is the list of diagnostics suggested to Iran for design and fabrication by Prof. Michael Walsh, the head of diagnostics in ITER.

The diagnostics could be broken down into 8 groups:

1. **Magnetics**
   - Continuous external Rogowski
   - Out vessel discrete Coils
   - Out Vessel Steady state Sensors
   - Partial and continuous flux loops
   - Halo Rogowski Coils
   - In-vessel coils
2. **Neutrons**
   - Radial neutron camera
   - Vertical neutron camera
   - Microfission chambers
   - Neutron flux monitoring (ex-vessel)
   - Gamma ray spectrometers
   - High resolution neutron spectrometer
3. **Optical**
   - Thomson scattering
   - Interferometer
   - Polarimeter
4. **Bolometric**
   - Bolometers
5. **Microwave**
   - Reflectometer
   - Interferometer
6. **Spectroscopic**
   - CXRS
   - Hα spectroscopy
   - VUV plasma
   - X ray crystal spectrometer Soft X ray radial spectrometer
   - H phase hard X ray monitor
   - Beam emission spectrometer
   - Divertor VUV spectroscopy
   - VUV edge imaging
   - XCRS edge imaging
   - Visible/IR cameras
7. **Neutral particle analyzer**
   - Neutral particle analyzer
8. **Plasma facing and operational**
   - Thermocouples
   - Pressure gauges
   - Residual gas analyzers
   - IR thermography
   - Langmuir probes
   - Erosion monitor
   - Dust monitor
   - Tritium monitor

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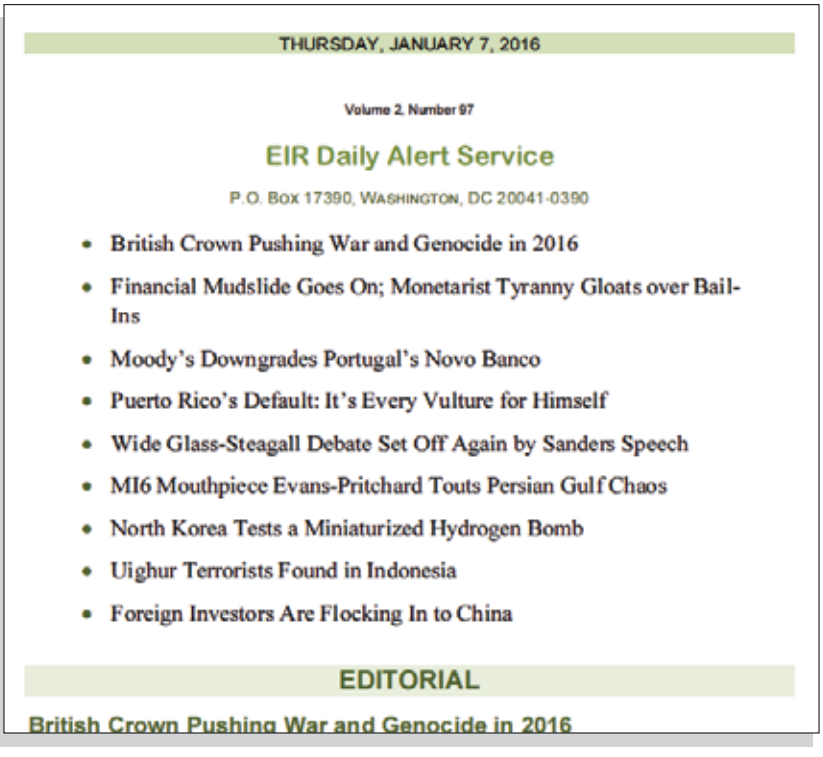

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