Science diplomacy in Iran

Warren E. Pickett, Anthony J. Leggett and Paul C. W. Chu

Iranian scientists are growing increasingly isolated because of political tensions between Iran and the West. We attempt to alleviate this problem through science diplomacy.

After the Iranian Revolution of 1979 when the Shah's government was replaced with the current Islamic Republic, universities were closed and hundreds of faculty members were dismissed, after which universities reopened under an Islamic educational system. Western academics have been unwelcome during most of the ensuing 35 years. The strained political relationship between Iran and the United States has had as one of its consequences a severe degree of isolation of Iranian science. Although some individual Iranian students and faculty have been able to spend periods in the United States, reciprocal visits and university-to-university contacts have been minimal.

Prompted by our concern for the isolation of Iranian scientists, the three of us visited four universities in Iran during the first two weeks of February 2014. Scientific research in Iran dropped precipitously during the Iran–Iraq war and has continued to receive low priority and scarce resources from the government, and purchases of Western equipment have become impossible owing to sanctions. We recognized that not only was Iranian science struggling to maintain some modicum of modern research, but each year it has been falling successively further behind.

The purpose of our visit was science diplomacy: to meet people on their turf, and to initiate and encourage scientific connections while getting at least a cursory first-hand look at the academic and scientific atmosphere in Iran. Mohammad Akhavan, Professor of Physics at the Sharif University of Technology in Tehran, whom we have known professionally and personally for several years, made our visit possible through tireless preparation. We follow up this visit by informing our colleagues, beginning with our own universities[1] and continuing with this Commentary.

Beyond our intention to communicate with and listen to all Iranians we might meet, we had specific tasks: (1) to give a plenary and a research lecture at the Fourth National Conference on Advances in Superconductivity (NCAS4) in Tehran, 6–7 February; (2) each to present a public lecture at one of the universities; (3) to accept appointments as adjunct professors in the Physics Department of Sharif University of Technology to aid our continuing connections with Iranian scientists; and (4) to join as scientific advisors to the nascent programme, International Research Collaboration on Physics of Advanced Materials (IRPAM), housed within the Physics Department at Sharif. We attended the inauguration ceremony of IRPAM at Sharif University during our visit.

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Figure 1 | Visitors and hosts on historic palace grounds in Tehran. Left to right: Paul Chu, Yasaman Akhavan, Tony Leggett, May Chu, Farzaneh Akhavan, Jill Pickett (below), Mohammad Akhavan (above), Warren Pickett and Nasim Akhavan.

Somewhat to our surprise, our interest in improving dialogue and understanding was fully matched at all levels. We attended meetings in which there were exchanges with several Iranian officials: from the Iranian Ministry of Science, Research, and Technology, including both the Minister Reza Faraji-Dana, and Deputy Minister for International Scientific Cooperation Hossein Salar-Amoli; Vice President for Research and Technology Sorena Sattari; Deputy of Technology and Innovation Mojtaba Khaham Nekouei; and former Minister of Cultural Heritage and Tourism Mohammad-Ali Najafi, whose office assisted in the coordination of the visit. President Reza Roosta-Azad of Sharif University was warmly hospitable and fully supportive of our visit.

All of these officials expressed enthusiasm about improving interpersonal relations between scientists on both sides, and working to correct the 'twisted pictures' that have grown among the peoples of both countries, fuelled by political rhetoric and the dearth of accurate information flow in both directions. Minister Faraji-Dana has emphasized[2] that current conditions for scientific work in Iran are not conducive to attracting back Iranian scientists who are currently working overseas, and this is a severe and costly brain-drain problem for

Iran. Faraji-Dana supports an improvement in conditions that would attract Iranian scientists to return to Iran for their career.

Our visit included meetings with the Physics Department chairs and faculty members of four universities (Sharif University of Technology, Isfahan University, Isfahan University of Technology and Shiraz University) as well as meetings with students. Many physics faculty were obviously chagrined by their inadequate research facilities and by their intellectual isolation, and were anxious for signs of improvement, but they have had difficulty seeing much hope for the foreseeable future. Some research, however, is getting done: there are currently 1,500 publications per year from 500 faculty members at Sharif.

Akhavan himself presents an example of persistence: he returned to Iran after receiving his PhD from Notre Dame in 1973 and proceeded to build the Magnet Research Laboratory there. Since the revolution he has been able to buy only one single item — a Lake Shore temperature controller. Nevertheless he has published over 100 papers in international journals since 1995. Iranian scientists suffer other challenges: recently they have encountered resistance[3] from some major Western scientific publishers to handling their submissions, quoting restrictions due to the Iranian Sanctions Act of 2010[4].

As noted above, each of us accepted an appointment as adjunct professor of physics at Sharif University, and joined IRPAM as scientific advisors. The 2010 Sanctions Act[4] restricts a great number of business activities with Iran, although humanitarian efforts by individuals and non-governmental organizations continue to be possible and even encouraged by the same act. Many activities, such as our own, lie between pure business and pure humanitarian. Although our interest is in fundamental research at the most basic level, beginning with the physics of advanced materials, it will escape no one's notice that physics also lies at the core of nuclear reactions; however, nuclear energy activities have been at the engineering level (not the basic research level) for decades.

As of this writing, officials at our universities are working with US agencies (State, Commerce, Treasury and its Office of Foreign Assets Control, OFAC) to learn whether some of our planned activities — collaboration on education and research — may require licences from the Treasury Department. On the brighter side, in March OFAC approved a general licence pertaining to academic and educational exchanges between Iran and the United States.

As is evident from the extent of our schedule, from the people with whom we were able to have discussions, to the exposure at NCAS4, Mohammad Akhavan succeeded in making our visit a prominent one within Iran. We were filmed in public and in meetings, and in several interviews, by a Tehran television station and by Sharif University. We overheard one day on the street a comment (translated by Akhavan): "Those are the American scientists we saw on TV last night!"

Fortuitously, the visit included the 10 days of annual celebration of the Iranian revolution of February 1979, this year being the 35th anniversary. Whereas in the United States we may hear each year of "thousands of demonstrators at Iranian universities shouting slogans such as 'death to America'," the demonstration or two witnessed in Shiraz by us American visitors involved 100–200 persons, without great enthusiasm for the demonstration being evident. On the more personal level, every person we met on the streets or in bazaars gave positive, happy responses. Iranians we met spontaneously expressed surprise, but delight, that it is possible for Americans to obtain visas to visit Iran, and that they would make the effort to come and meet Iranians, and begin to learn about their society, customs and opinions. A group of 11–12-year-old schoolgirls, whom one would expect to have heard many unpleasant accounts of Americans (much as Americans hear negative information about Iranians), were delighted to meet us, have pictures taken with us and secure a few autographs.

Certainly, succeeding in obtaining a visa to visit Iran is not simple, just as it is correspondingly challenging for Iranians to obtain visas to visit the United States. The personal letter of invitation to each of us from President Roosta-Azad (Sharif), along with the effective garnering of Iranian support at several levels by Professor Akhavan, may have been vital for the approval of our visas.

Our visit to Iran, although one of very few such visits by academics, was not the first. To our knowledge, the first visit by Western academics to Iran since 1979 was in 2004, by a small group of vice chancellors and deans from the University of California at Davis led by Chancellor Larry Vanderhoef and hosted by the former president of Sharif University, Saeed Sohrabpour. We have heard of only a few visits to Iran by academics since that time; they are still a rare event, and we encounter surprise from American colleagues that they can happen at all.

The term 'science diplomacy' appears in the title of this article. Our activities are fully in keeping with the intent and, we hope, the practice of science diplomacy, which is encouraged officially by the US State Department, with ties to the American Association for the Advancement of Science (AAAS). AAAS has a formal Office of Scientific Diplomacy and publishes a quarterly journal on the topic, *Journal of Science Diplomacy*. The (UK) Royal Society endorses scientific diplomacy; its document *New Frontiers in Science Diplomacy*[5] includes a case study, "Using science to strengthen relations with the Islamic world." Science diplomacy is squarely in line with the intent of the

Figure 2 | Mohammad Akhavan's Magnet Research Laboratory at Sharif University of Technology. Foreground, left to right: Warren Pickett, Tony Leggett, Mohammad Akhavan and Paul Chu.

Forum for International Physics as well as other activities of the American Physical Society. The primary idea is to extend existing connections and initiate new ones at the personal scientist-to-scientist level to supplement connections through non-governmental organizations.

Science diplomacy has some high-profile history. In the 1960s a group of US physicists paid a visit to USSR physicists in Moscow followed by a reciprocal visit, coordinated by the national academies of both countries. This contributed to mutual understanding that basic research was already at that time intrinsically an international activity. The 'ping-pong diplomacy' of the early 1970s involved an invitation from China for the US ping-pong team to visit and compete, with a reciprocal visit soon after. This new communication between the two countries was followed by visits to China by Henry Kissinger and then President Nixon, followed not long after by the opening of diplomatic relations between the United States and China. Although it is hard to predict the impact of this science diplomacy effort between Professor Akhavan and the three of us, history provides optimism to expect some positive impact.

An excerpt from *New Frontiers in Science Diplomacy*[5] reads: "Such platforms for ongoing dialogue and collaboration are vital, especially at moments of tension. For example, after Iran's elections in June 2009, Iranian scientists called on the international research community to 'do everything possible to promote continued contacts with colleagues in Iran, if only to promote détente between Iran and the West when relations are bellicose'[6]. Scientists, both within and outside of Iran, have a part to play in promoting a society that is more open to rational, critical thinking."

In our meetings with physics faculty, we confirmed the sustained excellence of the Iranian educational system: Iranian graduate students are considered and admitted alongside other international students at major universities in the United States and Europe, and 60% of students at government universities are women. Whereas certain areas of university education can be improved (undergraduate laboratories and research opportunities, for instance), the greatest need and the toughest challenge is in graduate-level research. Faculty expertise is in place; in fact, many physics faculty have education and research experience in the West. A primary problem is that modern infrastructure and laboratory equipment are lacking; funds are scarce, and the current sanctions prevent such purchases anyway. Remarkably, some faculty have displayed strong self-reliance, managing to build their own laboratory equipment. Exacerbating the poor research climate is that scientific publications are difficult to access, not so much because of restrictions of any kind, but because of the cost of subscriptions to most leading publications.

The recent US–Iran agreement temporarily alleviating sanctions against Iran in exchange for concessions of Iran's nuclear programme provides a climate for a real improvement in relations between the two countries. The willingness of Iranian officials to meet with American scientists to promote scientific connections and collaborations provides additional encouragement, and we believe that there is substantial interest within the American (and more generally Western) physics community to build an effective science diplomacy effort. Although we caution that one should not build overly steep expectations, it seems that the time is ripe for using science not only to build connections but also to enhance education and research efforts of both countries and, not least, to begin to enhance goodwill among currently antagonistic societies. This message is squarely in line with the assurance in the Iranian Sanctions Act of 2010 [Sec. 3(10c)] that the US people and government "hold the people of Iran, their culture, and their ancient and rich history in the highest esteem"[4]. Now is the time to provide support for our scientific colleagues in Iran. ❐

Warren E. Pickett is in the Department of Physics, University of California at Davis, One Shields Avenue, Davis, California 95616, USA; Anthony J. Leggett is in the Department of Physics, University of Illinois at Urbana–Champaign, 1110 West Green Street, Urbana, Illinois 61801–3080, USA; Paul C. W. Chu is at the Texas Center for Superconductivity, University of Houston, 3201 Cullen Suite 202, Houston, Texas 77004, USA.
e-mail: pickett@physics.ucdavis.edu; aleggett@illinois.edu; cwchu2@central.uh.edu

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The impact of helium shortages on basic research

W. P. Halperin

Helium is non-renewable. It is used in many areas of scientific research but demand is fast outstripping supply. We must adapt, and quickly.

Scientists from a wide spectrum of disciplines use liquid helium. Biologists and chemists require high-resolution superconducting magnets for NMR and mass spectrometry; physicists and materials scientists need it in research discovering quantum materials and new physical principles, building devices for metrology and quantum information; in medicine, radiologists must have helium for their MRI magnets. But addiction to helium is particularly strong among physicists. We need its cryogenic properties to operate stable superconducting magnets that generate high magnetic fields, and to work at sub-kelvin temperatures. Our dependency on liquid helium is directly related to its versatility as a cryogenic liquid. It does not freeze even at absolute zero temperature. It has very large cooling power, essentially vibration-free. The problem with helium