In Memoriam

Fang Lizhi (1936–2012): An Appreciation

James H. Williams*

Fang Lizhi, the Chinese astrophysicist and political dissident, died on 6 April 2012, in Tucson, Arizona. He left China in 1990, after a year spent inside the US consulate in Beijing. Fang and his wife had gone to the consulate for refuge following the violent suppression of the 1989 democracy movement, which the Chinese authorities accused him of fomenting. In 1992 Fang took a position teaching physics at the University of Arizona, where he worked until the time of his death at age 76. He never returned to China.

Fang Lizhi's life story is remarkable, and provides a unique window into recent Chinese history. He was born in 1936 in Beijing, where his father was an accountant for the national railroad. He grew up under Japanese occupation, and joined an underground Communist youth organization during the Nationalist interlude. At the age of 16, Fang was admitted to Beijing University in physics, the premier department in China's premier university. Fang's professors included many of China's top foreign-educated physicists, who also served as government advisors and research institute directors. While at Beida, Fang was admitted to the Communist Party, and met physics classmate Li Shuxian, his future wife. He graduated at the top of his class in 1956 and was assigned to the Chinese Academy of Sciences (CAS) Institute of Modern Physics, where at age 21 he led a team doing calculations – sometimes by abacus, in the absence of computers – to optimize nuclear reactor design for production of plutonium for weapons.

In May 1957, during the Hundred Flowers movement, Beida became ground zero for criticisms of the Party. Physics students played a leading role, due partly to their prestige and partly to their privileged access to foreign news sources, which made them aware of events in the Soviet bloc such as Kruschev's criticism of Stalin and the Hungarian uprising. Though he had graduated, Fang was frequently on campus visiting Li Shuxian, who had been posted there after graduation as a translator for a Soviet expert. The two took part in the Hundred Flowers criticisms, and as a result became targets the following month when Mao Zedong reversed course and launched the Anti-Rightist campaign. Li was labelled a rightist, dooming her physics career. Fang avoided the worst consequences simply because the Party required CAS to purge five per cent of its personnel as rightists, and this quota was met before Fang's activities came to light. Nonetheless, he was removed from classified weapons research and expelled from the Party.

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The Anti-Rightist campaign was the beginning of a 20-year odyssey during which Fang, like many other Chinese scientists and intellectuals, sought to pursue a career and raise a family in the midst of political upheaval and frequent assignments to manual labour in China's hinterland. At various times Fang grew millet, raised livestock, planted trees, dug railroad tunnels and worked in electronics and camera factories. He was reassigned to a teaching position at the newly formed Chinese University of Science and Technology (CUST) in Beijing, and was also able to unofficially join the CAS Institute of Physics research team that built China's first laser. While his political status prevented him from publishing articles using his CUST affiliation, he slipped through the cracks of official censorship by using his informal affiliation with the Institute of Physics, and despite his manual labour stints became one of the most widely published physics researchers in China in the early 1960s. Fang and Li married in 1961 in the depth of the post-Great Leap Forward famine and had their first child in 1963. During the Cultural Revolution, students on the CUST campus engaged in violent confrontations wearing makeshift armour. Fang stayed clear of the fray initially but was denounced during the Purify the Class Ranks campaign in 1968, and sentenced to confinement in a "cowshed" dormitory room with other professors for a year, during which time ten of his colleagues committed suicide. In 1969, as part of the "third front" mobilization that relocated strategic assets into China's interior, students and faculty physically moved CUST to its new home in Hefei, Anhui. Fang was later part of a work team that made the bricks from which the new CUST campus buildings were constructed.

A pivotal point in Fang's life and career came during a 1969 assignment to a May 7th cadre school in Huainan, Anhui, where his responsibilities included mining coal and carting the dead victims of the campaign against May 16th elements (a conspiracy later shown never to have existed) in a wheelbarrow to the morgue. While deep in the coal mine, Fang heard bitter complaints by ordinary miners who felt victimized by Mao and the Communist Party. This was a political epiphany for Fang, who up to that point had retained hope that the Party's policies were at least benefiting the majority of peasants and workers. After a day's work in the mine, Fang would hide beneath the mosquito netting in his dorm and read a secreted copy of the Soviet physicist Lev Landau's text on classical field theory, which led to a fascination with general relativity and cosmology. As Fang later described it, "during those months Landau's book became my . . . only sustenance. When night fell and I lay in my netting exhausted from the day's labour, my soul would roam the expanding universe . . . It was from this time that I fell in love with astrophysics."[1]

In 1972, as Nixon's visit to China led to a rapprochement in the US–China relationship, scientists returned from manual labour to the lab, and scholarly journals resumed publication. In December, Fang became the first Chinese

1 Fang 1991a, 63. Cited in Williams 1999, 70.

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physicist to publish a research article on modern relativistic cosmology, and specifically the Big Bang theory. Fang's article was technical and straightforward, but its political context was not. Einstein and the Theory of Relativity had been strenuously denounced in China during the Cultural Revolution; the substance of this campaign drew heavily from similar campaigns under Stalin in the 1930s and 1940s. As a result, even though as Fang said "there could not have been more than one hundred persons in China who really understood relativistic cosmology,"[2] his article became a centrepiece of the factional struggle surrounding Mao's succession, in which the Maoist left accused the pragmatists associated with Zhou Enlai and Deng Xiaoping of pursuing reactionary policies in science – "the satellites may fly to the sky, but the Red Flag falls to the ground."[3] From early 1973 until Mao's death in 1976, at least 30 articles criticizing the Big Bang theory in general and Fang's paper in particular were published by the Maoist left in the national news media (including *People's Daily*) and in academic journals. The thrust of the criticism was that Big Bang cosmology contradicted the dialectical materialist doctrine of the infinite universe contained in such Marxist-Leninist classics as Engels's *Anti-Dühring* and *Dialectics of Nature*, and Lenin's *Materialism and Empirio-Criticism*.

Fang stood his ground in the face of these attacks, publishing several new papers arguing that recent developments such as radio-telescope observations had created an empirical basis for cosmology to be studied through the usual methods of science, rather than through philosophical discourse. The campaign against the Big Bang had the unexpected result of allowing Chinese astronomers to hold scientific conferences to conduct "mass criticism"; under this pretext, nationwide astronomy meetings were resumed in 1974, and Fang's resistance became widely known among China's scientific community. A showdown of sorts occurred at a national astronomy conference held at CUST in the summer of 1976, after Deng was purged and his "Outline Report" on science policy attacked by the resurgent Maoist left. With representatives of the Party's ideology departments attending, senior Chinese astronomer Dai Wensai declared publicly that he supported the Big Bang theory. The threat of repercussions for the conference leaders ended when Mao died in September and the Gang of Four were arrested a month later.

In the post-Mao era, Fang's scientific career blossomed. He published prolifically and became China's youngest full professor in 1978, a CAS academician in 1981, president of his professional society in 1983, and vice-president of CUST in 1984. He travelled abroad extensively to take up visiting scholar positions and establish scientific relationships between foreign and Chinese institutions; his first trip to a scientific conference in 1978 was so novel that his departure required direct approval from Hua Guofeng, Mao's interim successor. His CUST Center

2 Fang 1991a, 188. Cited in Williams 1999, 73.
3 Yao 1990, 458. The original "satellites" quote is from an article by Zhang Chunqiao, *Renmin ribao* (10 August 1973), cited in Domes 1977, 178.

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for Astrophysics was in turn visited by foreign luminaries such as Cambridge physicist Stephen Hawking, who complimented the centre as being "state of the art in astrophysics and cosmology."[4] Fang also participated in the de-Maoization of science, writing articles about the Cultural Revolution experiences of Chinese scientists that were sharply critical of political and ideological repression, likening Chinese cosmologists to Galileo and their Maoist oppressors to the Inquisition. For a time, these criticisms were compatible with the aims of the Dengist leadership, who wanted to normalize and reward scientific work in support of their technology and economic goals. But a chasm eventually developed between the authorities, who criticized the Cultural Revolution's chaos and privation in order to bolster the Party's political monopoly and economic development focus, and Fang, who criticized the Cultural Revolution's tyranny and mind control as an argument for intellectual and political freedom. Publicly contradicting Party theorists such as Hu Qiaomu, who insisted that dialectical materialism continue to play a "guiding role" in scientific research, Fang said bluntly that Marxist philosophy was useless to science, claiming (some would say gleefully) that he could find a scientific error on every page of Engels's *Dialectics of Nature*.

As the 1980s unfolded, Fang's public critique of Chinese politics and culture extended far beyond the realm of scientific research. He charged that the greatest obstacle to China's development was not "material shortcomings" that could be bridged through "purchases and acquisitions," but rather "cultural traditions and habits of mind."[5] In contrast to the official scientism of the Party's modernization drive, Fang argued that the greatest value of science was not as a technical discipline in the service of a technocratic state, but its role as a "cornerstone of modern thought."[6] Fang almost singlehandedly revived the May 4th movement theme of "science and democracy," which many early 20th-century intellectuals, including CCP founder Chen Duxiu, had embraced as guiding principles for China's modernization. The Party's "Four Modernizations" campaign, by contrast, aimed far too low:

> In the beginning we were mainly aware of the grave shortcomings in our production of goods, our economy, our science and technology, and that modernization was required in these areas. But now we understand our situation much better. We realize that grave shortcomings exist not only in our 'material civilization' but also in our 'spiritual civilization' — our culture, our ethics, our political institutions — and that these also require modernization.[7]

For Chinese intellectuals, Fang told students, modernization started with "straightening our bent backs" and speaking truth to power. He set a clear example, speaking plainly, criticizing leaders by name, and shining a spotlight on corruption and malfeasance. When asked by a reporter if his "four principles of academic freedom" might be seen as contradicting the regime's "Four

4 Wu 1986. Translated in Williams 1988, 95.
5 Fang 1991b, 56.
6 *Ibid.*, 107.
7 Fang 1989. Translated in Fang 1991b, 158.

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Upholds" (the socialist path, dictatorship of the proletariat, CCP leadership, and the leading role of Marxism-Leninism-Mao Zedong Thought), Fang responded: "Is it possible that science, democracy, creativity, and independence are in conflict with the Four Upholds? If so, it's because the Four Upholds advocate the opposite of science, which is superstition; the opposite of democracy, which is dictatorship; the opposite of creativity, which is conservatism; and the opposite of independence, which is dependency."[8]

Fang's themes featured prominently in street protests by college students against corruption and rigged local elections in late 1986. Though he worked behind the scenes to urge the students to return to their campuses, the Party's crackdown on the protests required official scapegoats, and Fang, journalist Liu Binyan, and writer Wang Ruowang were chosen. The Anti-Bourgeois Liberalization campaign had a paradoxical effect: as 500,000 copies of his selected writings and speeches were disseminated to Party branches throughout the country for study and criticism, Fang gained a much wider audience and became a folk hero. He was removed from his CUST post and transferred to the Beijing Observatory, but efforts to control or silence Fang invariably came back to embarrass the Party. Revoking Fang's travel privileges resulted in a torrent of international protest, including a letter from fellow physicist and dissident Andrei Sakharov.

In January 1989, Fang sent a hand-written note to Deng Xiaoping, asking for the release of Democracy Wall activist Wei Jingsheng and other political prisoners. (Wei said recently, "My gratitude to Fang remains immense … for the person whom Deng Xiaoping hated most to openly offend the dictator required enormous courage."[9]) Fang's note in turn precipitated two open petitions of support from prominent intellectuals, including the senior nuclear weapons physicist Wang Ganchang. In March, authorities used heavy-handed tactics to prevent Fang from attending a barbecue to which he had been invited by visiting US president George Bush, focusing worldwide media scrutiny on human rights violations in China. In the democracy protests that erupted spontaneously in April and May of 1989 following the death of Hu Yaobang, Fang avoided playing a direct role, concerned that his involvement would provide a pretext for the authorities to suppress the movement. His views, however, remained influential among the protesters; Beijing University students wore shirts with the legend "science and democracy." After the tragedy of June 4th, Fang and his wife were placed at the top of the public enemies list. At the urging of friends they took refuge in the US Embassy in Beijing, where their presence became an impediment to the normalization of relations between the US and China for more than a year. After lengthy negotiations, Fang and Li were released, and following stays in Cambridge and Princeton, ultimately settled in Arizona.

8 Fang 1991b, 180.
9 Wei 2012.

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In exile, Fang remained engaged with China, participating in human rights campaigns, giving talks and interviews, publishing articles and writing letters on behalf of political prisoners. He worked with many organizations including Human Rights in China, the International League for Human Rights, the Committee of Concerned Scientists, and the Committee on International Freedom of Scientists. He received honours for both human rights and scientific work, and was named a fellow of the American Association for the Advancement of Science (AAAS) and the American Physical Society. He retained his passion for science, and for teaching science and training young people. Of the 340 scientific journal articles, book chapters and conference papers in his *curriculum vitae*, more than half were published between 1990 and 2012, an average of about eight papers per year. He worked with more than 125 co-authors, served on international scientific committees, helped to organize major conferences, and continued to build linkages between China and the rest of the scientific world, including the Beijing-Arizona-Taipei-Connecticut (BATC) survey project, one of China's most significant collaborations in astronomy.

Fang's research focused on the structure and evolution of the early universe, the formation of galaxies, and the role of dark energy and dark matter. The range of phenomena he was conversant with was extremely broad, from quantum processes to the expansion of the universe. The bulk of his papers might best be characterized as observational cosmology, in that they took the limited data available from astronomical observations – mostly, the spectral lines of light emitted aeons ago from impossibly distant objects – and applied many kinds of rigorous mathematical analyses to them, to tease out the patterns and test which theoretical models were consistent or inconsistent with the data. One of Fang's great skills in science was to recognize the patterns and underlying dynamics of the universe given the observed data, and then to explain it to people in a very simple and direct way. This was perhaps his greatest skill as an observer of Chinese society as well.

The death of a hero in exile is as tragic in real life as in mythology, and there is immense pathos for those who admired Fang to realize that he will never return home. Yet he did not pass quietly into obscurity, he did not become bitter, and he did not lose his humility, his honesty, his sense of humour or his passion for the things he cared about. These are great triumphs in the midst of a tragic situation. For China on the other hand, the tragedy of Fang's exile – and the exile and imprisonment of others like him, from Wei Jingsheng to Liu Xiaobo, who have spoken with a clear voice and without fear about the observable reality around them – is not mitigated by its emergence as a superpower. Since Fang's path and China's path diverged in 1989, there has been prodigious progress in China's material modernization, but not in its political culture, evidenced most recently in the Bo Xilai affair's exposure of corruption, cynicism and lack of accountability within the Party's highest ranks. This is unlikely to change until the spirit of truth-telling that Fang Lizhi embodied is finally invited home to a hero's welcome.

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