王淦昌论文选集

SELECTED WORKS OF WANG GANCHANG

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SELECTED WORKS OF WANG GANCHANG

一九八六年八月于中国原子能科学研究院
顾明远 摄

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序　言

王淦昌同志是我国实验原子核物理、宇宙射线及基本粒子物理研究的奠基人之一. 他生于一九〇七年,一九二九年毕业于清华大学物理系,一九三〇年赴德国柏林大学留学,在迈特纳(Lise Meitner)教授指导下从事 β 衰变能谱研究,于一九三三年获得博士学位. 一九三四年回国担任山东大学教授. 一九三六年后任浙江大学教授.

抗日战争期间,浙江大学几经搬迁,到贵州湄潭不久,他独具卓见地提出了验证中微子存在的实验方案. 然而在贫穷落后的旧中国却不可能付诸实施,于是他写了一篇短文寄往美国的《物理评论》,发表于一九四二年一月. 不数月,美国阿伦博士(J. S. Allen)按照这一建议初步证实了中微子的存在. 以后,实验核物理学家们继续按照王淦昌同志的建议,进行了一系列工作,最终确认了中微子的存在.

淦昌同志在解放前就开始了宇宙线的研究. 一九四七年,在美国利用宇宙线研究了 μ 介子衰变特性. 回国后,在浙江大学因陋就简地筹建了宇宙线实验室. 解放后,一九五〇年到中国科学院近代物理研究所工作,一九五二年任该所副所长. 在党、政府的支持下,一九五三年到一九五六年期间,他领导建立了云南落雪山宇宙线实验站,利用多板云雾室和磁云雾室研究基本粒子及其相互作用,取得了一大批奇异粒子事例,研究了奇异粒子性质,使我国宇宙线研究进入了当时国际先进行列.

一九五六年,他奉派赴苏联杜布纳联合原子核研究所工作. 一九五八年担任了该所副所长. 他直接领导的研究组发现了反西格玛负超子($\bar{\Sigma}^-$),成为该所一百亿电子伏质子同步稳相加速器上最重要的科研成果.

淦昌同志也是我国核武器研制的主要奠基人之一. 他于一九六〇年从苏联回国,次年三月调任核工业部第九研究院副院长. 他不仅参与了我国原子弹、氢弹原理突破及第一代核武器研制的实验研究和组织领导,而且在爆轰试验、固体炸药工艺研究和新型炸药研制,以及射线测试和脉冲中子测试方面,指导解决了一系列关键技术问题. 在开展地下核试验过程中,他花费了巨大的精力和时间,研究与改进测试方法,使我国仅用很少次数的试验,就基本上掌握了地下核试验测试的技术关键. 淦昌同志一直十分重视核武器研制中的基础研究工作. 早在一九六二年,他就领导开展了新兴的脉冲X射线技术的研究,用于测量瞬时压缩度问题. 在他的指导下,建成了大型强流脉冲电子加速器.

一九六四年,淦昌同志和苏联巴索夫院士同时独立地提出了用激光打靶实现核聚变的科学设想. 按照他的建议,在中国科学院上海光学与精密机械研究所开展了钕玻璃强激光打靶的研究工作. 一九七四年他进一步阐述了我国开展惯性约束聚变研究的重要性. 以后,一直指导着我国高功率激光聚变和粒子束聚变研究工作. 一九七八年,淦昌同志调任核工业部副部长兼原子能研究所所长后,还亲自指导一个研究室,从事粒子束驱动核聚变基础研究和电子束激发的准分子激光的研究.

由于他对祖国科学技术事业和国防建设的卓越贡献，使他成为两项国家自然科学一等奖和一项国家科学技术进步特等奖的主要获得者之一．近六十年来，淦昌同志一直奋斗在科研前沿，为我国核科学技术的发展不断开拓新的科学领域．

淦昌同志十分重视核能的开发和利用，在他先后担任核工业部副部长和部科学技术委员会副主任期间，他以极大的热忱积极地推动我国的核电建设，为我国核电事业迈出艰难的一步起了重要作用．

淦昌同志热爱祖国的科学事业．一九五五年，被遴选为中国科学院数理化学部学部委员．他曾任中国科学技术协会副主席和中国核学会第一届理事长．为促进与发展国际、国内学术交流，增进科学家之间的友谊与合作，做了大量的工作．

淦昌同志的贡献是多方面的．他的教学、科研和社会活动的经历，告诉我们一个真理：只有在中国共产党领导下，建立了新中国，我国科学家的聪明才智才能得到充分的发挥．

本选集收集了王淦昌同志部分公开与未公开发表的科学论文．从这里我们可以看到他在科学上探索与开拓的艰辛足迹、丰富与活跃的学术思想和实事求是的治学作风．

中国原子能科学研究院发起编辑王淦昌同志的论文选集，这是一件很有意义的活动．我深信本选集不仅是一个历史的记录，而且对读者有所启迪，特别是中青年科学工作者将从中受到莫大的鼓舞．

严济慈

1986 年 10 月

Preface

Professor Wang Ganchang, one of the founders of the researches on nuclear physics, cosmic ray and particle physics in China, was born in 1907. Graduated from the Department of Physics, Qinhua (Tsing Hua) University in 1929, he went abroad to study at Berlin University in 1930, where, under the guidance of Professor Lise Meitner, he devoted himself to the studies of β spectroscopy and earned his doctorate in 1933. He returned home in 1934, and was professor, first in Shandong University, then, from 1936, in Zhejiang University.

During the war of Resistance against Japanese Aggression Zhejiang University made repeated moves before settling down at Meitan, Guizhou Province. Shortly thereafter, with exceptional insight Professor Wang proposed an original experimental programme to prove the existence of neutrino. However, it could not be put into practice in the poor, backward old China. So he wrote a short paper and submitted it to the journal PHYSICAL REVIEW of the United States, which accepted it. The paper was published in January 1942, in light of which Dr. J. S. Allen in the United States soon first preliminarily proved, and since then many other scientists through lots of work have confirmed, neutrino's existence.

Professor Wang started research on cosmic ray before liberation. In 1947 while staying in the United States he studied the properties of μ meson decay with cosmic ray. After returning to China, he worked and tried all means available in that time and then successfully set up his cosmic-ray laboratory at Zhejiang University. After liberation he started working at the Institute of Modern Physics, Academia Sinica (Chinese Academy of Sciences) in 1950 and was appointed Deputy Director in 1952. During the period from 1953 to 1956, under the support of the Government and the Party he founded and directed the Laboratory of Cosmic Ray at Luoxue Mountain, Yunnan Province. By use of the multiplate cloud chamber and magnetic cloud chamber the elementary particles and their interactions were investigated. Numerous events of strange particles were observed, their properties studied, so that the research of cosmic ray in our country at that time reached the international advanced levels.

In 1956 he was sent to the Joint Institute for Nuclear Research, Dubna, U.S.S.R. and was appointed Deputy Director of that Institute in 1958. The group directly led by him discovered the anti-sigma minus hyperon $\bar{\Sigma}^-$, which has been the most important scientific achievement on the 10 GeV proton synchrocyclotron of the Institute.

Professor Wang is also one of the main founders of the research and development of nuclear weapons in our country. In March 1961, one year after returning from the U.S.S.R., he assumed the position of Deputy Director of the Ninth Institute of the Ministry of Nuclear Industry. He played a leading role, not only in the breakthroughs in the principles of both the atomic and hydrogen bombs, in the experi-

mental research, and in the organization and lead of research and development for the first generation of nuclear weapons, but also in solving a number of technical key problems in implosion tests, research of technology of solid explosives, development of new types of explosives and the measurements of radiations and pulsed neutrons. In the development of underground nuclear tests he devoted much of his time and efforts to the studying and improving of the methods of measurements and tests, so that the key techniques of measurement in underground tests were mastered only after a few tests. Professor Wang has consistently paid full attention to the foundamental research in the development of nuclear weapons. As early as 1962 he led and carried out the research of newly developed technique of pulsed X rays for the purpose of measuring instantaneous compressibility. Under his direction a large accelerator with intense pulse electron beam was constructed.

In 1964 Professor Wang, in coincidence with Academician Basov of the U.S.S.R. but independently, put forward the scientific idea of realizing nuclear fusion by laser bombardment. Following his suggestion researches on the bombardment of targets with intense Nd glass laser were developed in Shanghai Institute of Optical and Precision Machinery, Academia Sinica. In 1974 he further expounded the significance of developing the research on inertia confined fusion in our country. Since then he has been directing the researches on nuclear fusion initiated by high power laser and particle beams. Though he was promoted to be Vice-Minister of the Ministry of Nuclear Industry and concurrently Director of the Institute of Atomic Energy in 1978, still he personally directed a laboratory carrying out foundamental research on particle beam driven fusion and excimer laser pumped with electron beam.

His excellent contributions to the cause of science and technology and to the construction of national defence of his Motherland have made him one of the chief winners of two first prizes of National Award of Natural Science and one special certificate of merit of National Progress of Science and Technology. Professor Wang has been working in the forefront of the scientific research during the past sixty years and has continuously opened up new fields for the development of nuclear science and technology of our country.

Professor Wang has paid much attention to the development and application of nuclear power. During his term as Vice-Minister of the Ministry of Nuclear Industry and Vice President of the Ministry's Committee of Science and Technology he enthusiastically and actively promoted the construction of nuclear power stations in China. He played an important role at the beginning of the difficult course of development of China's nuclear power stations.

Professor Wang loves the cause of science of his Motherland. In 1955 he was elected a member of the Council of Mathematics, Physics and Chemistry of the Chinese Academy of Sciences. He was formerly Vice Chairman of the Chinese Society of Science and Technology, and first President of the Chinese Nuclear Society. He has made great efforts to promote and develop academic exchanges internally and internationally and to strengthen friendship and collaboration between scientists.

Professor Wang has made contributions in many fields. His experience in education, scientific research and social activities has shown us the truth: only under the leadership of the Chinese Communist Party and after the founding of new China can the wisdom and talent of Chinese scientists be brought into full play.

In this selection are collected only a part of Professor Wang Ganchang's scientific papers, published or unpublished. Reading it we can learn his arduous career of exploring and pioneering in science, his rich and active academic thought and practical and realistic style of scholarship.

It is of great significance that under the sponsorship of the Chinese Institute of Atomic Energy the selected works of Professor Wang Ganchang has been compiled. I firmly believe that this selection is not only a historical record, but also an inspiration to the readers, especially the young and middle aged scientific workers.

J. C. Yan
October, 1986

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ON ATMOSPHERIC RADIO-ACTIVITY AND PEIPING WEATHER.

By K. C. Wang (王淦昌)

Department of Physics.

Since the discovery of radioactive emanations in the atmosphere by Elster and Geitel[1], much experimental work[2] has been done to study the relationship between atmospheric radio-activity and meteorological conditions. In order to form a definite opinion upon this relation, it is certainly desirable to conduct experimental works at as many places in the world as possible. The purpose of the present investigation was to make a thorough study of the influence of the meteorological factors upon the atmosperic radio-activity in the vicinity of Peiping. The results reported here contain the observations taken in the interval of six months (November 1929—April 1930).

The method of the measurement was very similar to that employed by Deodhar[3]. A bare copper wire, 6 meters in length and 0.5 mm. in diameter, was stretched horizontally in open space outside the laboratory, and was kept insulated by means of a parafin rod. The distance of the wire from the ground was about 5 meters. It was charged to a negative potential of about 3,000 volts by a Wimshurst machine run by a small motor. As the electrostatic machine generally gives a very high potential (which amounts to the order of 10^5 volts), the negative electrode is connected to a variable resistance leak (Fig. Ia) in parallel with the exposed wire so as to reduce the potential to the required value. This leak was made of a blackened strip of hard paper similar to the grid leak in the radio set. The potential was measured by a static voltmeter (manufactured by Leybold's Nachfolger). The wire was exposed for exactly two hour

1 Elster and Geitel, Phys. Zeits., Vol. 4 (1902-1904).
2 Cf. Meyer and Schweidler, "Radioaktivitaet", Chap. 7, pp. 575-592
3 D 缺 Deodhar, Proc. Roy. Soc. A109, 280 (1925).

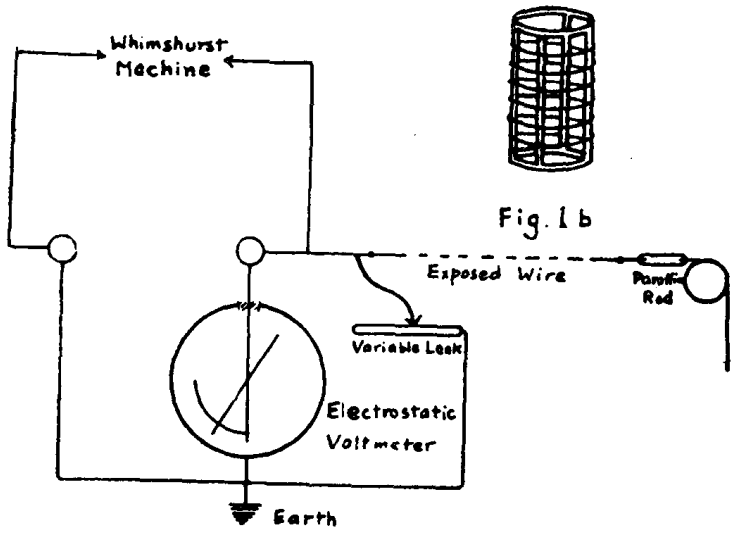

Fig. 1 a

and then carefully wound on a brass frame (Fig. 1b). The time required for this winding was about one minute and forty seconds. In every case, the wire could be introduced into the ionisation chamber of a gold leaf electroscope (Fig. 2) 2 minutes after the stoppage of the machine and the discharge rate of the leaf was noted by means of a reading microscope. The natural leakage of the electroscope was measured at the beginning and the end of every observation. In all cases it was found that this leakage was quite negligible.

In certain cases, it was found that the electrode of the electrostatic machine changed the sign of the charge during the experiment, especially when the weather was damp. This trouble was avoided by using a second machine to excite the original one at the beginning.

After each experiment the wire was introduced into a dilute solution of hydrochloric acid for about one hour and then rinsed with tap water and cleaned by rubbing it with cloth. This process was necessary in driving away the previous deposit before it is exposed again.