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The Effect of Argument on the Development of Physics

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***Abstract*—Each step for the development of physics is full of argument. By revealing defects of existing physical opinions and hypotheses, the argument can promote the cultivation and generation of new physical theories, accelerate the growth and perfection of physical theory, enhance scientific experiment to make progress, and become a kind of internal impetus for the development of physics; meanwhile, under certain conditions, argument can also exert a hinder effect on the fast development of correct physical theory, especially when the mode of argument is wrong, it will do harm to physics and psychology.**

Keywords—Argument; The development of physics; Positive function; Negative function

I. INTRODUCTION

Throughout the development of physics, each step for it to march forward has been directly promoted by the argument of different physical opinions and hypothesis, and all fields are filled with the argument of all kinds of different schools and academic opinions, so that we can say the development history of physics is the history about the argument of different physical opinions and hypothesis. While promoting the development of physics, argument can also inevitably cause certain negative influence on the development of physics.

II. POSITIVE EFFECT OF ARGUMENT ON THE DEVELOPMENT OF PHYSICS

A. Argument promotes the cultivation and generation of physical theory

Conflict is the prime power promoting the development of all things. In the development process of physics, the cultivation of physic theory is generally started from the discovery of conflicts in physics. When conflicts occur, physics holding different opinions will make every endeavor to find reasonable explanations and defense for their own opinions, theories and methods, and will criticize and reveal the conflicts, difficulties and unreasonable places of others as much as possible, and just in such argument process new physical theories can be gradually cultivated and perfected. There are numerous examples showing that argument can promote cultivation and generation of physical theories and a long-term, extensive and large-scaled fierce argument can generally promote the generation of many new theories, and then cause an explosion of scientific revolution. For instance, the argument of Galilean School and Aristotle School about object motion cultivated and generated Newton's Laws of Motion; the argument of earlier physicists about light nature cultivated and generated the Particle Theory of Light and Undulation Hypothesis Theory, and the further argument about Photoelectric Effect, X-ray Diffraction, Compton effect and other phenomenon explanations cultivated and generated the concept of Light Quantum, and finally made people know about the wave-particle dualism of light; as for the nature of cathode ray, British Scientist W. Crookes (1832-1919) put forward the theory that cathode ray was negatively charged particle flow, while German Physicist H. R. Hertz (1857-1894) thought that cathode ray is a kind of ether vibration wave, and the argument about whether cathode ray is a light wave or particle flow has lasted for above 20 years, and finally, it promoted British Physicist J. J. Thomson (1856-1940) to put forward the concept of electron based on experiment [1].

At the end of the 19th Century and the beginning of 20th Century, a revolution of physics taking quantum mechanics as the main achievement and basic symbol experienced a long-term, extensive and large-scaled fierce argument, and through the argument about the explanation of black-body radiation, it promoted the Pioneer of quantum mechanics—M. Planck (1858-1947) to put forward energy quantum hypothesis; through the argument about the explanation of hydrogen atom spectrum experiment, it promoted A. Einstein (1879-1955) to put forward light quantum hypothesis; through the argument about the explanation of hydrogen atom spectrum experiment rules, it promoted N. Bohr (1885-1962) put forward quantized orbit theory; due to the difference between the created matrix mechanics created by W. K. Heisenberg (1901-1976) et al. and the wave mechanics created by E. Schrodinger (1887-1961) et al. in form and meanings, it also caused the long-term and fierce argument of two parties' scientists, and finally it was proved that they were completely equivalent in mathematics, and then unified quantum mechanics theory was formed. From the cultivation to the generation of quantum mechanics, it has went through thirty years of fierce argument, similarly, the argument about the view of space-time and ether has also promoted the cultivation and generation of special relativity [2]. It can be seen that, as the basis of modern physics, quantum mechanics and relativity theory are benefited from long-term fierce argument.

B. Argument accelerates the growth and perfection of physical theory

Argument is a prominent signal and obvious mark to find physical problems and it can activate thoughts, stimulate inspirations, attract and mobilize physicists to focus on studying such physical problems. For instance, when studying the nature of light, there was a fierce argument between the particle theory of British Physicist I.Newton (1643-1727) and the undulation hypothesis of Dutch Physicist C.Haygens (1629-1695), and since Newton's particle theory looked simple, and can vulgarly explain common light phenomenon, while undulation hypothesis exposed its disadvantages in the argument, particle theory occupied a leading position in 18th Century [2]. At the beginning of 19th Century, British Doctor and Physicist T.Young (1773-1829) also put forward a relatively sound light undulation hypothesis, and excellently completed the famous two-slit interference experiment, and used light superposition principle to successfully explain light diffraction phenomenon; French Physicist A.J.Fresnel (1788-1827) independently found out the laws of the diffraction, and successfully explained light diffraction phenomenon; French Physicist J.L.Foucault (1819-1868) et al. calculated that the transmission speed of light in water was smaller than that in air, and then declared the victory of undulation hypothesis, but after 1980s, the photoelectric effect found thereby challenged undulation hypothesis, and Einstein put forward light quantum hypothesis, successfully explained photoelectric effect, and then revealed the unity and opposition for light volatility and particle property, and built a relatively comprehensive theory about the nature of light [3].

C. Argument promotes scientific experiments to make progress

Argument has not only promoted the generation and development of physical theory, but also promoted the generation of new experiment and the improvement of experimental methods. In the argument process, physicists will compete to find powerful evidences to prove the correctness of their own theories, and some evidences are theoretical, but most of them choose to reveal that others' theories are wrong though designing new experiment or improving experimental methods. For instance, in the argument about "heat is a substance or a sport", British Physicist C. Rumford (1753-1814) designed many experiments about the generation of heat by friction, to prove that thermal quality theory was wrong; in the argument of frog legs, Italian Doctor and Zoologist L.Galvani (1737-1798) connected the ischiadic nerve of frog legs to the muscle of another frog for experiment, to prove his "animal electricity" theory. While Italian Physicist A. Volta (1745-1827) used various kinds of different metal collocations to conduct a series of experiment [4], to prove "metal electricity" theory; in the argument about the completeness of quantum mechanics, Einstein successively designed three ideal experiments, including "single slit diffraction", "double slit diffraction" and "Einstein photon box."

The argument about the explanation of Pickering spectrum promoted Bohr to design helium discharge tube experiment, so as to make his quantum explanation gain a complete victory in argument. In 1897, American Astronomer P.W.Henry (1846-1919) found a line series similar to Balmer series. Every other spectrum in such line series almost coincided with the spectral line of Balmer series, but other spectral lines had rules at the two adjacent lines of Balmer series. Meanwhile, it was also found that those spectral lines that are almost coincided for the two-line series had obvious differences in wave length (or frequency) slightly. Sweden Spectroscopist J.R.Rydberg (1854-1919) through that both Pickering line series and Balmer line series were the spectrum of hydrogen, and also predicted that hydrogen should also have another principal line series, after that, Fowler also verified the existence of the principal line series of hydrogen—4846 line series. Thus, Rydberg's theory was commonly accepted by people.

After that, along with the Bohr's steady state hypothesis and frequency hypothesis being put forward, he also put forward hydrogen spectrum theory, successfully introduced "quantization conditions", and calculated the energy of electrons in hydrogen atom at each track: $E_n = \frac{1}{n^2} E_1$ (n = 1, 2, 3…). He holds that Pickering line series and 4846 line series weren't the spectral lines of hydrogen atom, but the spectral lines of ionized helium. The problem was acute, so argument was incurred accordingly. As for the completely different opinion of Bohr, people thought that his hypothesis was way too "bold" and "whimsical", without sufficient evidences, it was hard for people to believe his theory. Bohr also understood that, so in order to get hard evidences, he designed an experiment, filled a glass tube with extremely pure helium, and then conducted electro-optic discharging, so he obtained Pickering spectral line, which fully verified that Pickering spectral line was the spectrum of helium, not hydrogen. Besides, along with the development of argument, it has also promoted the generation and improvement of the experiment [5].

III. NEGATIVE EFFECT OF ARGUMENT ON THE DEVELOPMENT OF PHYSICS

A. Argument hinders the fast development of new theories

Argument is the main method and approach for solving physical conflicts and can exert a positive promotion function in the development of physics, but it has also hindered the fast development of new theories to some extent. New things in the development process of physics can often be incomplete at the beginning, so it can be easily doubted, rejected and even regarded by people as absurd theory. It can only circuitously develop in the argument and exploration process, and the speed is extremely slow. For instance, in the argument about wave-particle dualism, there were some disadvantages during the initial generation of undulation hypothesis, and it was under a bad situation for argument, but by virtue of Newton's authority, particle theory occupied a leading position throughout the entire 18th Century, and suppressed the development of undulation hypothesis; in the argument about the nature of heat, the contents about "the theory of heat is a substance" were

extremely identical to people's intuitive feeling and common sense, especially after "heat balance law" was established, people can easily associate the conservation of matter, so "the theory of heat is a substance" was accepted by people and entered into a period of great prosperity, and in the argument, the advantageous 'the theory of heat is a substance" recklessly criticized "the theory of heat is a sport" , which had made scientists who supported and studied "the theory of heat is a sport" less and less, and the development of "the theory of heat is a substance" remained stagnant for a time.

B. Argument damages the physical and psychological health of physicists

Argument can not only hinder the fast development of correct physical theory, when the mode of argument is improper, it will also cause serious physical and psychological harm to the two contending sides. In the argument process, the two parties had different opinions and clear flags, and they would acutely criticize and reveal all possible conflicts of the opposite party. If it is merely restricted to academic field, it is worthy of energetically advocating, but in most occasions, along with the white-hot development of argument, some physical workers adopt unhealthy approaches to damage the normal proceeding of physical argument, and also cause huge damage to the physical and psychological health of physicists. Great Physicist Newton used to be harmed, in 1672, Newton published a paper called New Theory about Light and Color [6], and deeply changed people's traditional cognitive concepts about light and color, with revolutionary significance in scientific history. However, there were also some people put forward suspicions and oppositions; British Famous Scientist H. Robert (1635-1703) was the first man criticizing him, and the argument between them was lasted for many years. At the beginning, it was well-intentioned, but then it had been turned into a battle of the books. H. Robert used to moralistically say to Newton that, young people should be engaged in the manufacturing of telescope, and let the elder to study important work, such as optical theory. When Newton newly published papers, H. Robert publically announced that he was happy to see the improvement and promotion of his ideas that were put forward a long time ago and weren't completed because of his busy work [7]. Besides, there were also some other people questioning Newton, such as Huygens and Lynas; finally, Newton couldn't stand such argument any more, and became angry from the initially defensive and annoyed, and finally, he became scared of all arguments. He couldn't stand that people said his opinions were burgled, so he decided to stop letting these meaningless argument waste his own precious time and energy, and concentrate on studying his own stuff, and for this purpose, he didn't want to communicate with others for several years[8]. Famous Indian Physicist and Nobel Prize Winner for Physics C. V. Raman (1888-1970) was also caught in the argument about diamond lattice vibration problems, and this argument made him suffer a lot spiritually, and then he gradually became a hermit, built high walls around Raman Institute, and hung up a sign of no visitors[9].

IV. CONCLUSION

To sum up, argument is the important means and valid approach for the development of physics. It can promote the cultivation and generation of physical theory, accelerate the perfection of physical theory, promote the progress of scientific experiment, and meanwhile, has certain negative influence, which will hinder the fast development of correct physical theory, and under special conditions, it will cause physical and psychological harm to the two contending sides. But as a whole, it is normal and beneficial to have various kinds of different academic opinions in the development of physics, and it is the symbol for prosperous science and flourishing academy, but this requests people to correctly treat argument, and only through arguments can we reveal conflicts, enlighten each other, and constantly promote theoretical perfection.

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