

The Schools of History of Physics as a tool for cultural development and dissemination

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Abstract: The Group of History of Physics (GSdF) of the Association for the Teaching of Physics (A.I.F.) annually organizes, since 2001, a formation school mainly addressed to the teachers of physics and of mathematics and physics in the secondary schools and to the interested university and PhD students. It aims to promote a better awareness of the interaction between the physics knowledge and the socio-economical sphere, according to the belief that on the basis of ignorance and superficiality it is impossible to build and preserve a solid and widespread scientific culture. The history of physics helps to highlight the relationships of physics with the most different cultural areas, in particular with history, mathematics, philosophy and biology, in order to promote an idea of physics as an integral part of the mankind culture and as a developing science and not as a dogmatic, unchangeable structure. Presenting the historical development of a concept, besides, helps the teacher to better understand the difficulties encountered by the students, so tracing a path for a possible their overcoming. Finally, the schools of history of physics represent a useful opportunity for the teachers to resume and deepen disciplinary contents without losing the link with the didactics.

Keywords: History of physics, Formation, Didactics.

1. Introduction

The Group of History of Physics (GSdF) of the Association for the Teaching of Physics (AIF) annually organizes, since 2001, a formation school mainly addressed to the teachers of physics and of mathematics and physics in the secondary schools and to the interested university and PhD students.

The schools of history of physics are carried out during the scholastic year and are mainly devoted to teacher formation and only secondarily to didactics.

For a whole week, a group of teachers works, under the guidance of experts and tutors, to improve their teaching and disciplinary skills. The speakers and coordinators, belonging to the university and the secondary high school, take care of the scientific activities, lending their work for free, except for the refund of travel and accommodation expenses. The costs are mainly covered by the AIF, with a variable contribution from the authorities and structures of the place in which the school is held.

The schools aim to improve physics knowledge and to promote culture in general, according to the belief that on the basis of ignorance and superficiality it is impossible to build and preserve a solid and widespread scientific culture and therefore the progress and the welfare of the mankind.

2. The history of physics as a useful opportunity

Only a teacher well-aware of the complex interactions among the knowledge of physics and the socio-economical and cultural spheres may be able to promote in his students the idea of a physics as an integral part of the cultural heritage of Humanity (Dibattista 2004, pp. 116-119).

A historical approach to the study of physics is also important from an educational point of view (Romagnino 2002). Supplying elements of history of physics, it may be useful to suggest a dynamical picture of physics, as a developing science and not as a dogmatic and unchangeable structure. Presenting the historical development of a concept, helps the teacher to better understand the difficulties encountered by the students, so tracing a path for a possible their overcoming. Finally, the history of physics can help to consolidate the critical spirit and prepare for flexibility, showing how the physicists of the past have often had to face, even in a dramatic way, the changes.

The historical approach is useful for researchers too, since the analysis of past arguments may also suggest ideas, keys of interpretation of the “reality”, useful for the comprehension and the eventual development or overcoming of the actual theories. The historical route of a concept or a theory problematizes and deepens its meaning and therefore improves its understanding. Paths abandoned before and then resumed in other form, suggest that nothing can be taken for granted but everything must be analyzed and discussed without prejudice.

This has been well understood already in the ‘70s, when the Project Physics Course, of which Gerald Holton was an outstanding figure, proposed a teaching based on the understanding of how science develops and on what is its impact on culture and society, as to be preferred to the simple training of the future physicists.

The history of physics helps also to highlight the relationships of physics with the most different cultural areas. In particular, in the various editions of the school, it was outlined the centrality of the relationships with history, mathematics, philosophy and biology.

The schools, that are characterized by a wise connection among the history of physics, disciplinary contents and didactics, represent finally a useful opportunity for the teachers to rethink and deepen their professional competences.

3. Articulation of the schools

The duration of the schools is of five days and they are residential.

The seminars are preferably held in the morning. They, for the different personalities and interests of the speakers, integrate with each other, ranging from the “internal history” of the discipline, which shows how the cognitive models of reality are modified with the development of scientific laws, to the historical evolution of science, inserted in the local cultural and social context.

Trainees are divided into three or four groups that, through afternoon meetings, discuss, under the supervision of GSdF coordinators, on subjects relevant to the school and indicated in advance in the program of the same. Each group develops a specific theme related to the general theme of the school to be carried out throughout the week with the intent to become aware of how to conduct historical research, how to deal with some conceptual issues and how to organize activities that can be transferred to the teaching.

In what above, the reading of original memories is central:

[...] allo scopo di far comprendere che, così come la letteratura si studia attraverso le opere degli autori che si sono distinti nei vari generi letterari, anche la scienza, essendo un prodotto della mente umana, deve essere studiata attraverso la lettura delle opere degli scienziati per capire come essi siano arrivati alle loro scoperte (Romagnino 2014, p. 152)

The fact that the course is residential promotes the exchange of experiences and the development of a climate of cultural community among the trainees, the speakers and the organizers of the school. It is a qualifying element of the school that distinguishes it from other training courses. Being together from morning to night, having to manage “collegial” times and ways of life, allows, in fact, trainees an educational and cultural exchange that goes well beyond the simple transmission of contents and techniques, allowing a deeper reflection on the concepts and on the role and functions of the transmission of Culture in general and of the teaching profession in particular.

The list of the titles of the schools from 2001 to 2018 is reported below:

- *La storia della scienza come base per la formazione dell'intellettuale scientifico*, Laboratori Nazionali del Gran Sasso - Assergi (AQ), 2001
- *L'immagine fisica dell'universo da Copernico ad Einstein*, Laboratori Nazionali del Gran Sasso - Assergi (AQ), 2002
- *La storia della Teoria dei Quanti*, Domus Galileiana - Pisa, 2003
- *Aspetti di Storia della Fisica dagli anni Trenta al secondo dopoguerra*, Salice Terme (PV), 2004
- *Nucleri e Particelle: aspetti di Storia della Fisica*, Castello Pasquino-Castiglioncello (LI), 2005
- *L'evoluzione del concetto di Campo dall'Ottocento ai giorni nostri*, Modena, 2006
- *Contesti teorici e scoperte sperimentali immagini della natura e modellizzazione in fisica*, Laboratori del Gran Sasso – Assergi (AQ), 2007
- *Per l'unità della scienza: fisica e biologia*, Brescia, 2008
- *Fisica e matematica: due storie intrecciate*, Ferrara, 2009

- *Figure e storie della fisica del Novecento*, Aosta, 2010
- *La dialettica continuo-discreto nella storia della fisica*, Terni, 2011
- *I principi di conservazione e le simmetrie nella storia della fisica*, Piacenza, 2013
- *Dal Germanio al Grafene: sulla storia della fisica della materia condensata*, Pisa, 2014
- *Fisica e probabilità, una lunga storia*, Messina, 2015
- *Sulla Storia dell'astronomia: il Novecento. Gli strumenti, le scoperte, le teorie*, Asiago (VI), 2016
- *Relatività e fisica quantistica: un matrimonio lungo un secolo*, Cagliari, 2017
- *Il nucleo: da Rutherford ai quark, via Los Alamos*, Policoro (MT), 2018

The next school will take place in Ferrara from February 25 to March 1 2019 and will have as its title: *La luce, una storia infinita*.

4. Documentation of the activities carried out

The proceedings of the schools are published on a supplement to *La Fisica nella Scuola* (LFNS), the quarterly review of the AIF, under the name of “*Quaderno*”. To date, seven of them (numbers: 27, 25, 22, 21, 19, 17, 14) have been published concerning the schools of the history of physics.

Materials and information related to all of the schools of history of physics are published on the website of the GSdF (<http://www.lfns.it/STORIA/index.php/it/>).

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