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Research Project
Seting up
a
Laboratory of Scientific Multimedia

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Introduction

The scientific research is the mathematical convention upon our perceptions and knowledge. As any other convention it establishes itself through communication. The incipient scientific research at the beginning of the recorded history was being communicated orally through talks and discussions, and in written forms as manuscripts. Socrates, Plato and Aristotle were talking, discussing and handwriting their thoughts about world nature. This way of communicating science continued until the middle of the past millennium, when printing has spread in Europe, and printed matter started to be widely disseminated. Printed periodicals of the academic societies, and printed books of learned authors appeared then, which helped to increase the number of those dealing with scientific matters, and the number of scientific questions. On such a rise, the science has been born, in close connection with God, as the mathematical convention on space, time, motion, atoms and matter. The issues related to such topics became soon too numerous and controversial as to require a revival of the oral form of the scientific communication. The beginning of such a reversal is landmarked by the 5th Solvay Congress in Brussels 1927, where consent was seeked upon the newly arisen quantal mechanics. Since then, oral and printed communication of the scientific research is dominating the modern science.

Audio-Visual Media in Scientific Research

Modern science employs abstract concepts to an increasing extent. Physics research lies at the forefront of this trend, since it is mathematical to the highest degree. The physical phenomena revealed by modern technological equipment do not affect directly our senses anymore, and our scientific knowledge is mediated by a sophisticated technology. On the other hand, an accurate knowledge requires an image, in order to correlate the space-time relations, to visualise the motion, to time-ordering the succession. Complex physical phenomena, which are not directly accessible to our senses, acquire new representations through scientific research, which are directly addressing our audio-visual senses. Audio-visual media in scientific research allow such scientific representations to be perceived directly. A new way is thereby established for communicating the results of the scientific research, which incorporates, in a close link, the mathematical equations with their graphic expression, in a single pictorial representation, to be directly perceived. In addition, audible comments and musical sounds provide direct explanations, and establish a rhythm and a formal frame of perceiving the conceptual contents, for organizing and ordering the perception of the pictorial representations. A unique audio-visual package is thus produced for communicating

scientific results. Additional music, voice, sound, graphic art may also be incorporated, to express more fully the scientific contents. Traditional written and oral presentations of the results of the scientific research are thereby united with communication means of the modern sensibility, resulting in scientific movies with writing, graphics, sound, voice, music, motion, with an appreciably enhancement of the informational load, which can now be transmitted in a direct way at a much higher rate. The main objective of the project is therefore that of producing scientific movies to the end of conveying results of the scientific research.

Results

There are particular scientific investigations whose results are most conveniently expressed in pictorial form. A recent experience in this sense was encountered when searched for the most stable forms of the atomic clusters, as predicted by the electron liquid theory of matter aggregation.[1]Geometric forms of high symmetries has been obtained for homo-atomic metallic clusters, including a long sequence of magic forms, and numerous shape isomers for clusters as large as consisting of 80 atoms. Surface geometric efects persist appreciably for clusters consisting of up to 1000 atoms, and intricate chain-like nanowire structures with a intertwined icosahedral symmetry have also be obtained. The most convenient way of presenting such results is their pictorial expression. It was therefore included in the scientific movie "Atomic Clusters", together with brief comments, as well as equations, diagrams, tables, figures, graphical representations, and a written theoretical review.[2] The movie has entirely been produced in electronic form, to be played on a PC computer.

In some other cases the physical phenomenon may proceed in space and time in such a complex way, that a motion picture may help appreciably to its understanding. This was the case with a newly proposed thermoelectric engine,[3] employing a pulse-transport of charge carriers, where the electric contacts must be operated periodically in a certain, prescribed rhythm, with a certain frequency, while the thermal contacts must be maintained continuously; the charge carriers are flying in discrete packages from the hot end of the thermoelectric sample to its cold end, pumping heat builds up pulses at the hot end, which are deflated of their thermal energy at the cold end by extracting heat, everything being correlated according to the prescribed frequency. This physical phenomenon has also been presented in the "Thermoelectrics" movie,[4] produced in electronic form. Both these movies are now distributed on Cds; a copy is attached to the present project.

Outline of the Activity

Four kinds of electronic scientific multimedia are envisaged to be produced, mainly. First, there is the scientific movie whose main contents are scientific results obtained by electronic computation. It targets primarily the researchers community. Secondly, there are simulations of physical phenomena either by computing or by electronic animation, or both; they are intended both for presenting scientific results and for the instruction process of the students. In particular, the electronic simulation of the basic physical phenomena may replace the usual hardware laboratories of the instruction process in the physics departments of the universities by virtual electronic laboratories. Thirdly, animated movies presenting phenomena for popularization, combined with digitally recorded experiments are proposed. And finally, digitally recorded oral presentations of the speaker, including succession of slides, comments and explanations, are intended for the usual academic lecturing process; class might take the course individually, each on one's own computer,

[1]L. C. Cune, M. Apostol, Phys. Lett. **A273** 117 (2000).

[2]L. C. Cune, M. Apostol, "Atomic Clusters", *apoma Pictures*, MB (2001).

[3]M. Apostol, M. Nedelcu, Non-Steady-State Thermoelectric Conduction, J. Optoelectr.&Adv. Mat. **3** 125 (2001).

[4]L. C. Cune, M. Apostol, "Thermoelectrics", *apoma Pictures*, MB (2001).

in one's own rhythm, with anyone's feedback, the get-together time being left for free discussions, thus contributing to a more flexible form of education, in accordance with the nowadays habits.