

International Science Education Symposium on Particulate and Structural Concepts of Matter

University of Athens
Central Historical Building, Panepistemiou Street
Athens, Greece, 5-8 November 2010



UNDER THE AUSPICES OF:



*University of Athens and its
Department of Primary Education*



University of Ioannina

ORGANISERS:

George Kalkanis, *Professor of Physics,
Department of Primary Education,
University of Athens*

Georgios Tsaparlis, *Professor of
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Speakers*

Adbo, Karina (*Linnoeus, Sweden*)
Akaygun, Sevil (*Bogazici, Istanbul, Turkey*)
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Eilks, Ingo (*Bremen, Germany*)
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Steffensky, Mirjam (*IPN Kiel Germany*)
Talanquer, Vicente (*Arizona, USA*)
Tsaparlis, Georgios (*Ioannina, Greece*)
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Wiser, Marianne (*Clark, USA*)

* The Symposium Program is available at the sites

<http://www.kodipheet.gr> and <http://micro-kosmos.uoa.gr>

Διεθνές Συμπόσιο Διδακτικής Φυσικών Επιστημών
ΣΩΜΑΤΙΔΙΑΚΕΣ ΚΑΙ ΔΟΜΙΚΕΣ ΕΝΝΟΙΕΣ ΤΗΣ ΥΛΗΣ
(Particulate and Structural Concepts of Matter)

Υπό την Αιγίδα των ΠΑΝΕΠΙΣΤΗΜΙΩΝ ΑΘΗΝΩΝ και ΙΩΑΝΝΙΝΩΝ

Κεντρικό Κτήριο Πανεπιστημίου Αθηνών (Οδός Πανεπιστημίου)

5-8 Νοεμβρίου 2010

Διοργανωτές του συμποσίου είναι οι *Γεώργιος Θεοφ. Καλκάνης*, Καθηγητής Φυσικής, Π.Τ.Δ.Ε. Πανεπιστημίου Αθηνών και *Γεώργιος Τσαπαρλής*, Καθηγητής Διδακτικής Φυσικών Επιστημών, Τμήμα Χημείας, Πανεπιστήμιο Ιωαννίνων. Οι ομιλητές είναι προσκεκλημένοι.

Υπάρχει δυνατότητα παρακολούθησης του Συμποσίου από ακροατές με προκαθορισμένο αριθμό. Αν ενδιαφέρεστε παρακαλείστε να επικοινωνήσετε με τον Γεώργιο Τσαπαρλή με τηλεμήνυμα στην διεύθυνση gtseper@cc.uoi.gr. ΔΕΝ υπάρχει τέλος παρακολούθησης.

Στο Συμπόσιο θα συμμετάσχουν ως ομιλητές οι παρακάτω (η σειρά αναγραφής είναι σύμφωνα με το πρόγραμμα του συμποσίου): Hannah Sevian (University of Massachusetts, USA), Philip Johnson (University of Durham, UK), Constantinos P. Constantinou (University of Cyprus), Ingo Eilks (University of Bremen, Germany), Dimitris Psillos (University of Thessaloniki), Marianne Wisner (Clark University, USA), George Papageorgiou (University of Thrace), Mirjam Steffensky (IPN Kiel Germany), Marijn R. Meijer (Utrecht University, the Netherlands), Bhawani Venkataraman (The New School for Liberal Arts, New York, USA), George Kalkanis (University of Athens), Sevil Akaygun (Bogazici University, Istanbul, Turkey), Avi Hofstein, Rachel Mamlok-Naaman, and Tamy Levy Nahum (The Weizmann Institute of Science, Israel), Georgios Tsaparlis (University of Ioannina), Joseph Krajcik (University of Michigan, USA), Ajda Kahveci (Canakkale Onsekiz Mart University, Turkey), Canan Nakiboğlu (Balikesir University, Turkey), Vicente Talanquer (University of Arizona, USA), Iztok Devetak (University of Ljubljana, Slovenia), Karina Adbo (Linnoeus University, Sweden), Constantine D. Skordoulis (University of Athens).

Το πρόγραμμα του συμποσίου έχει αναρτηθεί στον ιστότοπο «*Κόμβος Διδακτικής Φυσικών Επιστημών και Εκπαιδευτικής Τεχνολογίας*» (ΚοΔιΦΕΕΤ) <http://www.kodipheet.gr> και στον ιστότοπο του Εργαστηρίου Φυσικών Επιστημών και Τεχνολογίας του Πανεπιστημίου Αθηνών <http://micro-kosmos.uoa.gr>

PROGRAM

International Science Education Symposium on Particulate and Structural Concepts of Matter

Under the auspices of:



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University of Athens
Central Historical Building, Panepistemiou Street
Athens, Greece, 5-8 November 2010

SHORT PROGRAM

FRIDAY, 5 NOVEMBER 2010

- 17.00-18.00 Registration
18.00-18.30 Addresses
18.30-19.50 **Session 1:** LEARNING PROGRESSIONS FOR TEACHING
A PARTICLE MODEL OF MATTER, part I
20.00-21.30 Reception

SATURDAY, 6 NOVEMBER 2010

- 08.30-10.30 **Session 2:** STUDENTS' AND TEACHERS' MENTAL MODELS OF
THE PARTICULATE NATURE OF MATTER, part I
10.30-13.30 Visit to the Acropolis Museum (including a lunch break)
14.30-16.30 **Session 3:** PRE-K, KINDERGARTEN AND PRIMARY SCHOOL
16.30-17.00 Coffee Break
17.00-18.20 **Session 4:** CONTEXT-BASED TEACHING AND LEARNING
18.30-19.50 **Session 5:** EDUCATIONAL TECHNOLOGY
20.00-23.30 Symposium dinner

SUNDAY, 7 NOVEMBER 2010

- 09.00-10.30 **Session 6:** CHEMICAL BONDING, part I
10.30-11.00 Coffee break
11.00-12.20 **Session 7:** CHEMICAL BONDING, part II
12.30-14.00 Lunch break
14.15-16.50 **Session 8:** LEARNING PROGRESSIONS FOR TEACHING
A PARTICLE MODEL OF MATTER, part II / STUDENTS' AND
TEACHERS' MENTAL MODELS OF THE PARTICULATE NATURE OF
MATTER, part II
17.00-19.30 Social activity
20.00-23.00 Optional dinner at the 'Strofi' restaurant

MONDAY, 8 NOVEMBER 2010

- 08.30-10.30 **Session 9:** CHEMICAL REACTIONS, CHEMICAL PHENOMENA
10.30-11.00 Coffee break
11.00-12.30 **Session 10:** HISTORY AND PHILOSOPHY OF SCIENCE /
QUANTUM MECHANICS, QUANTUM CHEMISTRY
12.30-13.15 Conclusions and closing of the Symposium

PROGRAM ¹

FRIDAY, 5 NOVEMBER 2010

17.00-18.00 Registration

18.00-18.30 Addresses

Session 1 (18.30-19.50): LEARNING PROGRESSIONS FOR TEACHING A PARTICLE MODEL OF MATTER, part I

(Chair: Avi Hofstein, Discussant: Constantinos P. Constantinou)

18.30-19.00 *Hannah Sevian and Marilyne Stains*

Mental models held by students and cognitive constraints hindering progress in understanding of the structure and motion of matter for students aged 13 through undergraduate level (*p. 12*)

19.00-19.30 *Philip Johnson*

How students' understanding of particle theory develops: a learning progression (*p. 13*)

19.30-19.50 Discussion

20.00-21.30 Reception

SATURDAY, 6 NOVEMBER 2010

Session 2 (08.30-10.30): STUDENTS' AND TEACHERS' MENTAL MODELS OF THE PARTICULATE NATURE OF MATTER, part I

(Chair: George Papageorgiou, Discussant: Marianne Wiser)

08.30-09.00 *Constantinos P. Constantinou, Michael Michael, Loucas Louca*

A modeling scaffolded approach to promoting the active invention and elaboration of interpretive particle mechanisms by students aged 10 – 12 years old: the impact of epistemological frames on the invention of conceptual models as interpretive frameworks (*p. 14*)

¹ In case of multiple-author papers, the presentation will be made by the first author. After the title of each presentation, the page number of the abstract is given as (*p. X*).

SATURDAY, 6 NOVEMBER 2010 (continued)

09.00-09.30 *Ingo Eilks, Janina Bindernagel*

Teachers' ways through the particulate nature of matter in lower secondary chemistry teaching: a continued change of different models vs. a coherent conceptual structure? (*p. 14*)

09.30-10.00 *Eleni Petridou, Euripides Hatzikraniotis, Maria Kallery, and Dimitris Psillos*

A study on exploratory use of microscopic models as research tools: the case of polarization (*p. 15*)

10.00-10.30 Discussion

10.30-13.30 Visit to the Acropolis Museum. Transfer by metro.* (Including lunch at the museum restaurant - participants must pay for themselves.)

* At Panepistimio Metro Station, take Line 2 of Metro, direction Aghios Dimitrios, and get off at 'Acropoli' station (the second stop). Ticket price: 1 euro.** Validate your ticket on entering the station.

** A 1 euro ticket allows unlimited travel for 90 minutes on all Athens means of transport, including metro, excluding the Airport-Athens bus service. A 3 euro/10 euro ticket allows unlimited travel as above for one day/one week.

Session 3 (14.30-16.30): PRE-K, KINDERGARTEN AND PRIMARY SCHOOL

(Chair: Tami Levy Nahum, Discussant: Dimitris Psillos)

14.30-15.00 *Marianne Wiser and Victoria Fox*

Quantifying amount of material: a teaching intervention in preK and kindergarten (*p. 17*)

15.00-15.30 *George Papageorgiou*

Explanations of chemical changes in relation to the structure of substances in young ages (*p. 18*)

15.30-16.00 *Mirjam Steffensky and Ilka Parchmann*

Do we need particulate concepts in primary science? (*p. 18*)

16.00-16.30 Discussion

16.30-17.00 Coffee break

Session 4 (17.00-18.20): CONTEXT-BASED TEACHING AND LEARNING

(Chair: Karina Adbo, Discussant: Ingo Eilks)

17.00-17.30 *Marijn R. Meijer, Astrid M.W. Bulte & Albert Pilot*

Macro – micro thinking: implementation of meso–structures in secondary chemistry education (*p. 19*)

SATURDAY, 6 NOVEMBER 2010 (continued)**17.30-18.00** *Bhawani Venkataraman*Chemical origin of life as a context for teaching introductory chemistry
(*p. 20*)**18.00-18.20** Discussion**Session 5 (18.30—19.50): EDUCATIONAL TECHNOLOGY**

(Chair: Canan Nakiboglu, Discussant: Constantine Skordoulis)

18.30-19.00 *George Kalkanis*From scientific to educational Monte Carlo simulations of microKosmos
in the frame of scientific/educational methodology (*p. 20*)**19.00-19.30** *Sevil Akaygun and Loretta Jones*The effects of computer visualizations on students' mental models of
dynamic equilibrium (*p. 21*)**19.30-19.50** Discussion**20.00-23.00** Symposium dinner**SUNDAY, 7 NOVEMBER 2010****Session 6 (09.00-10.30): CHEMICAL BONDING, PART I**

(Chair: Ajda Kahveci, Discussant: Vicente Talanquer)

09.00-09.40 *Avi Hofstein*Teaching and learning the concept of chemical bonding (*p. 22*)**09.40-10.10** *Rachel Mamlok-Naaman*The bonding concept: twenty years of misconceptions of chemistry high
school students (*p. 23*)**10.10-10.30** Discussion**10.30-11.00** Coffee break**Session 7 (11.00-12.20): CHEMICAL BONDING, PART II**

(Chair: Sevil Akaygun, Discussant: Rachel Mamlok-Naamann)

11.00-11.30 *Tami Levy Nahum*New directions for teaching the chemical bonding concept - A new
bottom-up framework (*p. 23*)

SUNDAY, 7 NOVEMBER 2010 (continued)

11.30-12.00 *Georgios Tsaparlis and Eleni Pappa*

Intra- and inter-molecular bonding: learning hierarchies in the literature of general chemistry and in the States-Of-Matter Approach (SOMA) (*p. 24*)

12.00-12.20 Discussion

12.30-14.00 Lunch break

Session 8 (14.15-16.50): LEARNING PROGRESSIONS FOR TEACHING

**A PARTICLE MODEL OF MATTER, part II /
STUDENTS' AND TEACHERS' MENTAL MODELS OF
THE PARTICULATE NATURE OF MATTER, part II**

(Chair: Mirjam Steffensky, Discussant: Philip Johnson)

14.15-15.30* *Joseph Krajcik*

Supporting students in building a particle model of matter (*p. 11*)
* (including a discussion part at the end of the presentation)

15.30-16.00 *Ajda Kahveci*

Assessing student conceptions of the particulate structure of matter: two-tier testing (*p. 16*)

16.00-16.30 *Canan Nakiboglu and Keith S. Taber*

Turkish students' perceptions of the atom in relation to a common teaching analogy (*p. 16*)

16.30-16.50 Discussion

17.00-19.30 Optional social activity: Transfer by metro to Monastiraki* and walk toward Theseion, with stop (around 17.45) for coffee at a Cafeteria.

* At Panepistimio Metro Station, take Line 2 of Metro, direction Aghios Dimitrios, and change (at the first stop) at Syntagma for line 3, direction Egaleo. Monastiraki is the first stop. Ticket price: 1 Euro.**

** A 1 euro ticket allows unlimited travel for 90 minutes on all Athens means of transport, including metro, but excluding the Airport-Athens bus service. A 3 euro/10 euro ticket allows unlimited travel as above for one day/one week.

20.00-23.00 Optional dinner at participants' expenses in 'Strofi' restaurant, 25 Rovertou Galli Street and Propylaion Street (across the Herodeion Theatre at the foot of the Acropolis). À la carte menu. Cost per person around Euro 25.00. Participants, who will have taken the previous social activity, will walk from Theseion to the Strofi Restaurant along the Apostolou Paulou Street, followed by the Dionysiou Areopagitou Street. The others can go to the restaurant by taxi or by bus No. 230 or by the Metro (Acropoli Station).

MONDAY, 8 NOVEMBER 2010

**Session 9 (08.30-10.30): CHEMICAL REACTIONS,
CHEMICAL PHENOMENA**

(Chair: Bhawani Venkataraman, Discussant: Hannah Sevian)

08.30-09.00 *Vicente Talanquer*

How do chemistry students design chemical substances and processes?
(p. 25)

09.00-09.30 *Iztok Devetak, Janez Vogrinc, and Saša A. Glažar*

The influence of submicrorepresentations on pre-service primary school teachers' understanding of the chemical reactions between halogens
(p. 25)

09.30-10.00 *Karina Adbo and Keith S. Taber*

Developing chemical understanding in the explanatory vacuum: Swedish high schools students' use of an anthropomorphic conceptual framework to make sense of chemical phenomena (p. 26)

10.00-10.30 Discussion

10.30-11.00 Coffee break

**Session 10 (11.00-12.30): HISTORY AND PHILOSOPHY OF SCIENCE /
QUANTUM MECHANICS, QUANTUM CHEMISTRY**

(Chair: Iztok Devetak, Discussant: Marijn R. Meijer)

11.00-11.30 *Constantine D. Skordoulis*

Investigating the historical development of the concept of matter from ancient atomism to quantum mechanics (p. 27)

11.30-11.50 *Canan Nakiboğlu*

The relation of prospective chemistry teachers' working memory capacity with their cognitive structure variables: the case of quantum mechanical theory of atom (p. 28)

11.50-12.10 *Georgios Tsaparis, Georgios Papaphotis, and Christina Stefani*

Teaching and learning the basic quantum chemical concepts: conceptual versus algorithmic learning, students' levels of explanations, models, and misconceptions, and attempts at conceptual change (p. 29)

12.10-12.30 Discussion

12.30-13.15 Conclusions and closing of the Symposium

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