
http://cost.obs.ujf-grenoble.fr/
http://www.cost.eu/
What is COST
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

• Money funded by an independent agency (COST), overseen by the EU
• COST is an intergovernmental agency, with > 30 European countries + some others Nearest Neighbors, ...
• Its aim is to foster cooperation between European labs, with special emphasis on enabling the 'Inclusiveness Countries' and balancing funds and opportunities across countries, genders, stage of careers
• No research funded, exclusively cooperation, meetings, schools. No funding of congress, attendance to congress
• Some outreach funding, a few special funds for 1 person attending large international meeting and explaining goals
• Action divided into Working Groups, aims, goals.

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How to relate astrophysical history and chemical history?

Pre stellar core
- $6K \leq T \leq 15K$
- $n \approx 10^4 \text{ } 10^6 \text{ } \text{cm}^{-3}$
- $N_2H^+, \text{CO, dust}$
- Still Complex organic molecules detected

Young stellar object, with hot corino and jets
- $10K \leq T \leq 700K$
- $n \approx 10^5 \text{ } 10^7 \text{ } \text{cm}^{-3}$
- Inhomogeneous
- COM's, FIR signals

Proto-planetary disk
- Very inhomogeneous
- $10K \leq T \leq 700K$ (PDR)
- PAH's simple molecules, dust

Fossil objects in the Solar System: comets. Comae:
- Density not uniform at all (flux of H2O)
- $50 < T < 1500$

Solar mass objects
Telescope frequencies, for some high resolution instruments (Heterodyne)

GBT, VLA < 50 GHz

IRAM/NOEMA 80... 270 GHz

ALMA 80... 950 GHz

Herschel 480 ... 1910 GHz (HIFI)
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<th>Pre-stellar core</th>
<th>Proto-stellar object</th>
<th>Proto planetary disk</th>
<th>Comets</th>
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<td>Quantitative observation of molecular content of comae</td>
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<td>Isotopomers</td>
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Characterization of molecular spectra of new species such as C-chains at low temperatures in a cold trap (4-12 K)

amorphous solid water (ASW) irradiated with near-IR light (2.6-2.9 µm) leads to a surface reorganisation and a change of its catalytic potential

Potential consequences for the catalytic role of ices in proto-stellar cores and protoplanetary disks

[Noble, Martin, Fraser, Roubin, Coussan, JCP (2014), 5, 826]
La deutération de l'eau dans la proto-étoile de faible masse

Les populations normalisées de di"misation de présentée en Figure 3.11 est d'environ 2.3. Les contours de l'abondance interne est de 1.8 et 3.10 – En

Dans le Chapitre 3. La deutération de l'eau dans la proto-étoile de faible masse

L'incertitude à 3.10 : les raies de HDO observées avec HIFI, IRAM et JCMT en direction de la proto-étoile IRAS 16293. En rouge, le meilleur modèle obtenu en ajoutant une couche d'absorption avec une densité de colonne de HDO de ~ 2.3 x 10^13 cm^-2 à la structure. L'abondance interne est de 1.8 x 10^-7 et l'abondance externe de 8 x 10^-11.

Figure 3.10. — En rouge : les raies de HDO observées avec HIFI, IRAM et JCMT en direction de la proto-étoile IRAS 16293. En rouge : le meilleur modèle obtenu en ajoutant une couche d’absorption avec une densité de colonne de HDO de ~ 2.3 x 10^13 cm^-2 à la structure. L’abondance interne est de 1.8 x 10^-7 et l’abondance externe de 8 x 10^-11.

Dans le Chapitre 3. La deutération de l'eau dans la proto-étoile de faible masse
Figure 1.3
The abundances of methyl formate, dimethyl ether, formic acid, methanol, and formaldehyde during the warm-up phase around a star of intermediate mass (around 10 $M_\odot$), which lasts $2 \times 10^5$ years, after which the temperature of the core is 200 K. The heat-up occurs quadratically with time. The species in the ice mantles are designated by (s). Taken from Garrod & Herbst 2006, and provided in part by R. Garrod.
Who : Core group

• LW, Chair
• Inga Kamp, U. Groningen (NL), vice Chair
• Helen Fraser, Open University (UK), Grant Manager
• Yuri Suleymanov (CY), STSM manager

• WG's:
  • 1: (Gas phase chem.) Jes Jorgensen (DK), TBD
  • 2: (Icy surface chem) Herma Cuppen (NL), Dmitry Semenov (DE)
  • 3: (Photchem) Petr Slavicek (CZ), JH Fillion (FR)
  • 4: (Isotope effects) Charlotte Vastel (FR), Octavio Roncero (ES)
What did we do, what shall we do

• Meetings:
  • 3 general meetings in 4 years (May 2015, Prague; January 2017, Faro; October 2018).
  • At least 3 WG meeting/4 years → 12 grand total
    (WG1/4 Pisa; WG1 Garching; WG2/3 Faro)
  • 2/3 schools: Grenoble 2016 + Belgrade 2017 + ?
  • About 80 STSM's so far, many more to come
  • White paper about theory

• 28 European countries participate + one out of Europe, Tunisia + Switzerland
• Some invitations from overseas: Japan, USA
Some themes of the STSM's (80 grand total, up to now)

- Application of TRACE code to videos of dust aggregate collisions in microgravity
- New routes of COMs formation by electronic structure and kinetics calculations
- Quantum Chemical Investigations of the Catalytic Formation of H2 on TiC model surfaces
- Carbon chain oxides in star forming regions
- Ultra-low temperature chemistry of carbon atoms
- Low temperature reactivity
- Chemical evolution of star forming molecular cores
- Lab investigations of anion reactions in Titans atmosphere
- Effect of internal and kinetic energy on the reactions of methyl cations with hydrocarbons
- Kinetics and Dynamics of the Astro-Chemical Reaction CH+ + C --> C2+ + H
- Dynamics of complex-forming reactions of astrochemical importance
- Study of complex organic molecules in the ALMA survey of the protostar IRAS 16293-2422
- Theoretical modelling of the infrared spectra of PAH and their derivatives
- Unravelling Interstellar Chemical Recipes: Solid Formation of Proteins, Sugars, and Fats
- Diagnostics of DC gliding discharge fed by CH4-N2 and admixtures for the mimic of Titan’s atmosphere
- Selective THz Radiation Spectroscopy of Interstellar Water Ice Analogues
COST Action Our Astrochemical History CM1401

First General Meeting in Prague, May 26 - 29, 2015

The conference is open to the whole community of physical chemistry and astrochemistry. The maximum number of attendees is set to 100 people. The conference is co-organized by University of Chemistry and Technology Prague and will be held in J. Heyrovsky institute AS CR, v.v.i., which is a centre of fundamental research in physical chemistry, electrochemistry and chemical physics.

Local Organizing Committee

- Petr Slavíček, University of Chemical Technology Prague
- Eva Muchová, University of Chemical Technology Prague
- Daniel Hollas, University of Chemical Technology Prague
- Jan Chalabala, University of Chemical Technology Prague
- Martina Rubešová, University of Chemical Technology Prague
- Laurent Wiesenfeld, Institute for Planetary Science and Astrophysics "IPAG", Grenoble
COMPLEX ORGANIC MOLECULES IN SPACE: GAS-PHASE AND SOLID PHASE

AIMS OF THE SCHOOL

Astrochemistry is the field that studies how interstellar atoms combine into molecules, in the gas phase and on the surfaces of the interstellar grains. It is the interplay between these two processes that leads to the rich chemistry observed in space, at galactic and extragalactic scales. To extract all the information from the astronomical observations of molecules and exploit them at the best is, however, a truly multidisciplinary endeavor. It requires complementary approaches (observations, modeling, laboratory, theory) to be combined with accurate knowledge in several fields: astrophysics, chemistry, atomic and molecular physics, solid state physics. This implies different communities to work together and to learn to understand each other, whose languages are often very different.

It aims at offering a series of lectures on all the above interdisciplinary aspects of Astrochemistry, from the basic concepts to the state-of-the-art research in each of them. The scope is to train PhD students and young researchers of the different communities that make up Astrochemistry and foster the collaboration/networking among them.

PRACTICAL INFORMATION

The school is organized in two weeks of lectures complemented with extensive hands-on activities. The lectures will cover the following topics:
- Methods of detection and analysis of interstellar molecules;
- Basics of radiative transfer and astrochemical modeling;
- Interstellar chemistry and star formation;
- Basics on astrochemical processes;
- Methods for theoretical chemistry applied to gas phase and solid state interstellar chemistry;
- Basics of laboratory experiments for astrochemistry and spectroscopy;
- Proposal and applications writing.

This school is co-organized by Université Grenoble Alpes, CNRS, the RD5, and the COST Action CM1401 "Our Astrochemical Galaxy."
COMPLEX ORGANIC MOLECULES IN SPACE: GAS-PHASE ROUTES AND ISOTOPIC ENRICHMENT

First Annual Meeting of the WG1/WG4
COST Action 1401 Our AstroChemical History
Scuola Normale Superiore, Pisa (Italy)
March 7-8, 2016

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Report from the Workshop on
Theory of Gas Phase Scattering and Reactivity for Astrochemistry
Nov 23 – Dec 4, 2015

Laurent Wiesenfeld,1, * Wing-Fai Thi,2, † Paola Caselli,2, * Alexandre Faure,1, † Luca Bizzocchi,2, † João Brandão,3, † Denis Duflot,4, † Eric Herbst,5, § Stephen J. Klippenstein,6, † Tamiki Komatsuzaki,7, § Cristina Puzzarini,9, † Octavio Roncero,10, † Hiroshi Teramoto,7, † Mikito Toda,8, † Ad van der Avoird,11, § and Holger Waalkens12, †

1 IPAG, CNRS & Université Grenoble-Alpes, France
2 CAS@MPE, MPE, Garching, Germany
3 U. Algarve, Faro, Portugal
4 Physique des Lasers Atomes et Molécules, Univ. de Lille & CNRS, Lille, France
5 U. Virginia, USA
6 Chemical Sciences and Engineering Division Argonne National Laboratory, Argonne, IL, 60439 USA
7 U. Sapporo, Japan
8 Women U. Nara, Japan
9 U. Bologna, Italy
10 CSIC, Madrid, Spain
11 U. Nijmegen, The Netherlands
12 U. Groningen, The Netherlands
The "Astrochemical Week" will take place from Jan. 16, 2017 to Jan. 20, 2017.

The meeting will be hosted by the University of Algarve (Faro–Portugal) and take place in Olhão (see venue).

It will consist in three successive meetings:

- **The Second General Meeting of the Action (mid term meeting)**
  Tuesday 17 - Tuesday 19, January 2017.

- **WG2 specialised meeting, 'Chemistry inside ices'**

- **WG3 specialised meeting, 'Non thermal desorption'**
  Friday 20th, January 2017.
COME AND PARTICIPATE

- Total budget ~ 150 k€/year for Travel/schools/meetings/dissemination

- Short time scientific missions
  - 5 days ... 3 months
  - Easy paperwork
  - > 33 k€ for 2016.

- COST rules very strict, overseen a priori and a posteriori by Grant Holder (Open U) and by COST offices in Brussels.

- Key importance to balance of ages, gender, countries + 'inclusiveness countries'

- Participate in our meetings, organize the meetings!

- 2017
  - New general meeting+
  - theory school, August/September 2017, Belgrade (SR), with MOLIM
  - WG1-4 meeting

- 2018
  - Final General meeting (October)
  - Specialized meetings
  - WG1...4 meetings
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https://astrochem2017.sciencesconf.org

**FARO – U. ALGARVE - PORTUGAL**

**WE LOOK FORWARD TO SEEING YOU THERE !!!**