



Report from the event supported by RadioNet

TITLE *Astrochemistry: From nanometers to megaparsecs - A symposium
in honour of John H. Black*

DATE: *24-28 JUNE 2019*

LOCATION: *GÖTEBORG, SWEDEN*

MEETING WEBPAGE: <http://www.chalmers.se/en/conference/JHBlacksymp2019/>

HOST INSTITUTE: *CHALMERS UNIVERSITY OF TECHNOLOGY*

**RADIONET
BENEFICIARY / NO:** *OSO / 07*

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RadioNet has received funding from the EU's Horizon 2020 research and innovation programme under the grant agreement No 730562

Report:

1 SCIENTIFIC SUMMARY

Researchers from institutes throughout Europe, as well as from Canada, USA, Chile, Russia, Israel, and Japan, gathered in Gothenburg to present their work during one week at the symposium "Astrochemistry: from nanometers to megaparsecs". Astrochemistry is a cross-disciplinary field covering a broad range of subjects and the full scope of astrochemistry was represented in the program. It provided a rare opportunity for researchers to discover common interests with colleagues who work on very different problems. The common threads of molecules and light held together a large tapestry of phenomena, ranging from planets and comets, through interstellar clouds, to distant galaxies, and the early universe.

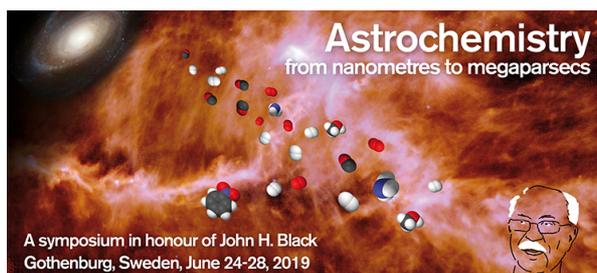
On the first day, the Deputy Lord Mayor of Gothenburg welcomed the participants with a fine speech about the importance of basic research and international cooperation in a city that values sustainability. The second afternoon was a dedicated poster session where presenters first each gave a 1-minute flash presentation of the main scope of their poster on stage, followed by a mingle where poster presenters could score other participants depending on their engagement as poster viewers. 24 posters were presented in total, out of which at least 6 presented observational results from RadioNet facilities, and the discussions were lively all across the room.

A few scientific highlights from the oral presentations throughout the week included:

- (1) David Neufeld presented the very recent discovery of a helium-containing molecule in space, HeH^+ .
- (2) Several speakers (Grenier, Tjus, Harada, Padovani) noted the important interplay between high-energy physics (cosmic rays and gamma rays) and the coldest, low-energy regions of interstellar molecular clouds.
- (3) State-of-the-art experimental techniques probe fundamental chemical processes and also provide new insight into the formation of planets and stars. Notable examples are new studies of poorly understood molecular ions CH_5^+ and H_5O_2^+ (Schlemmer) and novel investigations of processes in cryogenic ices (Romero, Watanabe, Miyazaki).
- (4) Many of the presentations featured recent observational results from RadioNet infrastructures IRAM 30m, NOEMA and APEX, as well as the Atacama Large Millimeter/submillimeter Array (ALMA). These were of special interest to the participants from our local radio astronomy community at Chalmers and Onsala Space Observatory and new contacts could be made and ideas born.

In particular, Linda Tacconi (invited speaker funded by RadioNet) opened the scientific part of the conference with a talk focusing on studies of dense gas and star formation in galactic disks, where IRAM and NOEMA has played a crucial role. As mentioned below, this talk was presented by her collaborator Amiel Sternberg. Javier Goicoechea (also funded by RadioNet) gave an inspiring talk Thursday afternoon on how observations of the reactive molecular ions CH^+ and SH^+ trace different formation processes in harsh environments, and where observations from IRAM has played an important role.

For a more detailed overview of the science scope of the event, the symposium webpage, <http://www.chalmers.se/en/conference/JHBlacksymp2019/>, contains a link to the abstract book where the full programme and abstracts for all the talks as well as posters are included.



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2 AGENDA OF THE EVENT

Monday, June 24

9:00 – 10:30 Registration & Coffee

10:30 Eva Wirström Welcome and logistics

10:40 John H. Black Opening talk

Photon-dominated processes Chair: Eric Herbst

11:10 Linda Tacconi (*invited*) Cold molecular extragalactic medium

11:50 Amiel Sternberg The atomic to molecular (HI-to-H₂) transition in Galaxy star-forming regions

12:10 – 14.00 Lunch

14:00 Nanase Harada (*invited*) Models of extragalactic astrochemistry

14:40 Evelyne Roueff (*invited*) Photon-driven chemistry

15:20 Maria S. Kirsanova Merged H/H₂ and C⁺/C/CO transitions in the Orion Bar PDR

15:40 – 16.10 Coffee

16:10 Sandra P. Treviño-Morales Probing the HI/H₂ layer around the ultracompact HII region MonR2

16:30 Ewine van Dishoeck (*invited*) Isotope selective photodissociation

17:10 Laura Colzi Enhanced nitrogen fractionation at core scales: the high-mass star-forming region IRAS 05358+3543

17:30 Deputy Lord Mayor Håkan Eriksson Welcome to the City of Gothenburg

17:40 City of Gothenburg reception

Tuesday, June 25

Simple molecules I Chair: Ewine van Dishoeck

9:00 Floris van der Tak (*invited*) Water in (high-mass) star formation

9:40 Olli Sipilä Modeling deuterium chemistry in dense cores: full scrambling versus proton hop

10:00 Shmuel Bialy The Multiphased HI Gas – from Solar to Low Metallicities

10:20 – 11:00 Coffee

11:00 Liv Hornekar (*invited*) Polycyclic Aromatic Hydrocarbons as catalysts for H₂ formation

11:40 Brett McGuire (*invited*) Detecting Complex (Polycyclic?) Aromatic Molecules in the ISM

12:20 Taissa Danilovich The circumstellar sulphur chemistry of AGB stars

12:40 – 14:00 Lunch

Simple molecules II Chair: Charles Lada

14:00 Carla Coppola (*invited*) State-to-state and non-equilibrium phenomena in the chemistry of the early Universe

14:40 Paul S. Barklem A final-state resolved merged-beam experiment of mutual neutralization of Li⁺ and D⁻ at stellar

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photo-spheric temperatures with DESIREE

15:00 Sebastien Müller (*invited*) Molecules towards QSOs

15:40 1-minute poster flash presentations

ca 16:00 – 18.00 Poster session and refreshments

Wednesday, June 26

Spectroscopy and Radiative transfer Chair: Maryvonne Gerin

9:00 Stephan Schlemmer (*invited*) Lab spectroscopy for astrochemistry

9:40 Geronimo Villanueva (*invited*) The delivery and evolution of water within the solar system studied via the D/H

10:20 – 10.40 Coffee

10:40 Elvire de Beck (*invited*) Spectroscopy of evolved stars

11:20 Hans Olofsson Heavy element recombination lines towards an evolved star: In the footsteps of John Black

11:40 Fereshteh Rajabi (*invited*) Dicke's Superradiance and Maser Flares

12:20 Martin Houde Non-Zeeman Circular Polarization of Rotational Molecular Spectral Lines

12:40 Takeaway lunch for pick-up

13:00 Bus departs for Excursion to Marstrand

Thursday, June 27

Cosmic rays and Energetic interactions Chair: Paola Caselli

8:40 Eric Herbst (*invited*) Cosmic Ray Driven Chemistry

9:20 Marco Padovani Cosmic rays: the ubiquitous probe for the interstellar medium

9:40 – 10:40 Poster session + Coffee

10:40 Isabelle Grenier (*invited*) Cosmic rays and the dark neutral medium

11:20 Julia Becker Tjus Ionization signatures and gamma-rays from supernova remnants

11:40 Christopher N. Shingledecker Simulating Ion-Irradiation Experiments using Astrochemical Models

Transient and non-equilibrium processes Chair: Susanne Aalto

12:00 Edith Falgarone (*invited*) Cold molecular gas around high-z starbursts

12:40 – 13:40 Lunch

13:40 Paola Caselli (*invited*) Isotopic Fractionation in Star-Forming Regions

14:20 Andrew Burkhardt Using Shocked Outflows to Probe Interstellar Ice Chemistry

14:40 Javier Goicoechea (*invited*) Reactive molecular ions as tracers of harsh interstellar environments

15:20 – 15:50 Coffee

15:50 Ilse Cleeves (*invited*) Transient chemistry in disks

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- 16:30 David Dubois Laboratory, modeling and observational study of benzene condensation on Titan's stratospheric aerosols
- 16:50 Thomas Ayres Carbon Monoxide in the Solar Atmosphere: from Photosphere to COmosphere
- 17:10 Lee Hartmann Special talk
- 18:30 Celebratory Dinner at Universeum

Friday, June 28

Gas/Solid interactions Chair: Gunnar Nyman

- 9:00 Naoki Watanabe (*invited*) The ortho-to-para ratio of hydrogen and water molecules desorbed from ice dust: experimental approach
- 9:40 Ayane Miyazaki Detection of OH radicals on amorphous solid water
- 10:00 Juan Enrique Romero Reactivity of HCO with CH₃ and NH₂ on Water Ice Surfaces. A Comprehensive Accurate Quantum Chemistry Study
- 10:20–11:00 Coffee
- 11:00 David Neufeld (*invited*) Small molecules observed at high spectral resolution with SOFIA: recent results from EXES and GREAT observations of two molecules, H₂ and HeH⁺
- 11:40 Serge Krasnokutski Experimental Characterization of Low- temperature Surface Reactions
- 12:00 Barbara Giuliano Direct measurements of the optical properties of CO ice in the THz range and opacity calculation
- 12:20 Gunnar Nyman Closing remarks
- 12.30 End of meeting

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3 PARTICIPANTS

There were in total 80 registered participants for the symposium, but after some late cancellations due to personal issues, in the end 75 participated in the whole, or parts of, the science programme (see list signed by organisers below, where M marks male and F female participants). The fraction of female participants was 32/75, i.e. 43%, and 17 out of 41 science talks were presented by women. Unfortunately, three of the invited female speakers cancelled their personal participation, but two of their talks were kindly presented by other present. This, however, shifted the gender balance in persons actually presenting invited talks, from the planned F/M of 13/22 to 10/21.

About 30% of the participants were affiliated with a university in Sweden, 40% with a European institute outside of Sweden, 20% from North America (USA and Canada), 8% from Asian countries (including Russia) and one from South America. 17 unique countries were represented at the symposium.

Approximately 40% of the participants were early career scientists (students and postdocs).

4 RADIO NET FINANCIAL CONTRIBUTION

RadioNet offered funding to 2 invited speakers for travel and lodging expenses (of 1000€ each). One could take the funding, the other one cancelled the personal participation. That talk was presented by a collaborator.

5 PUBLICATIONS

No publications have been planned as a result of this event, but if there are future publications the following acknowledgement will be used:

The project leading to this publication has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730562 [RadioNet]

6 CONFIRMATION:

Following the Regulation (EU) 2016/679 - General Data Protection Regulation-, we confirm that RadioNet is allowed to publish this report, incl. participants lists, statistic's details, pictures, etc.