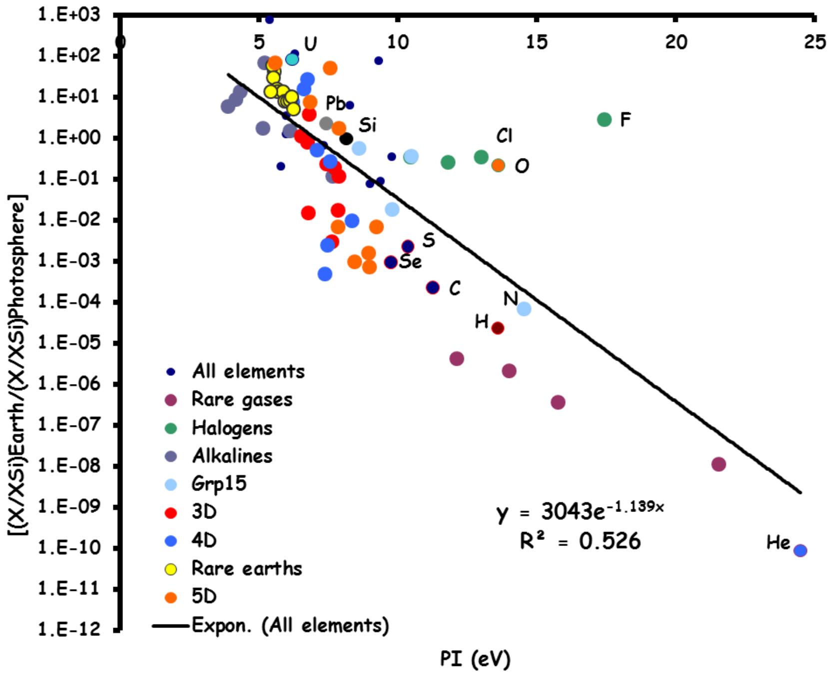
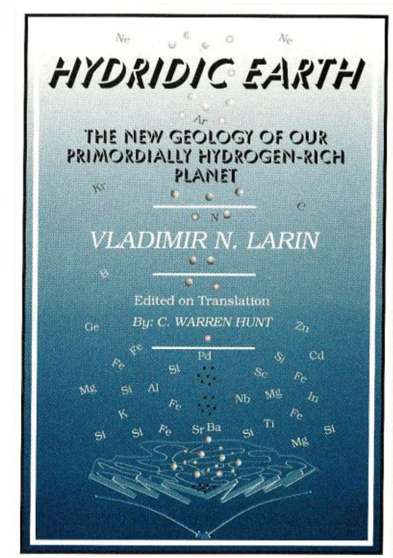
Primordially hydridic Earth

Viacheslav Zgonnik, Hervé Toulhoat, Vladimir Larin, Nikolay Larin

Abundances of elements on Earth's crust relative to Sun's photosphere and Si plotted versus first ionization potential (IP)



- Clearly shows separation of elements by their IP
- Outliers are due to use of only Earth's crust composition
- Tested with success for other planets, Moon and asteroids
- Described by a Boltzmann distribution depending on the distance to the protosun
- <u>Predicts high initial content of hydrogen</u>
- Earth currently has about 4% by weight of hydrogen.
- It is mainly combined as hydrides and partly dissolved into other phases



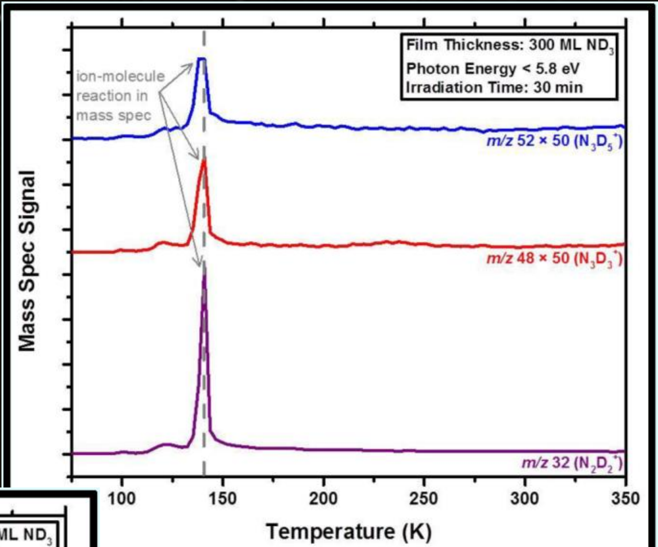
http://arxiv.org/abs/1208.2909v2

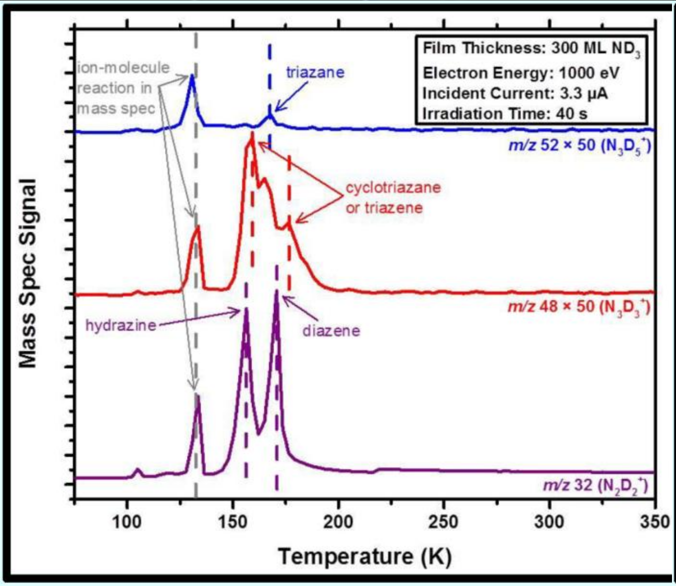
Non-Ionizing UV (< 7 eV) Photochemistry of Cosmic Ice Analogs of Ammonia

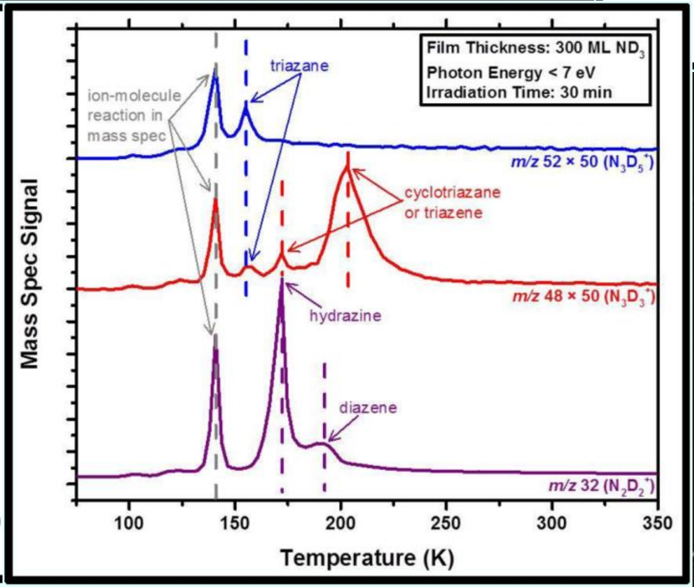
Radiolysis involves electron excitation due to particle radiation in addition to all ionization

- reactions initiated by cations
- production of low-energy electron cascade
- non-uniform distribution of reaction intermediates, non-selective chemistry leading to multiple reaction products

Photochemistry involves electron excitation without ionization







We see production of N2 and N3 species with high-energy electrons and < 8 eV photons, but not with < 6 eV photons

Theoretical study of Rydberg states of HeH^+ ion using the Halfium model

Islem Bouhali

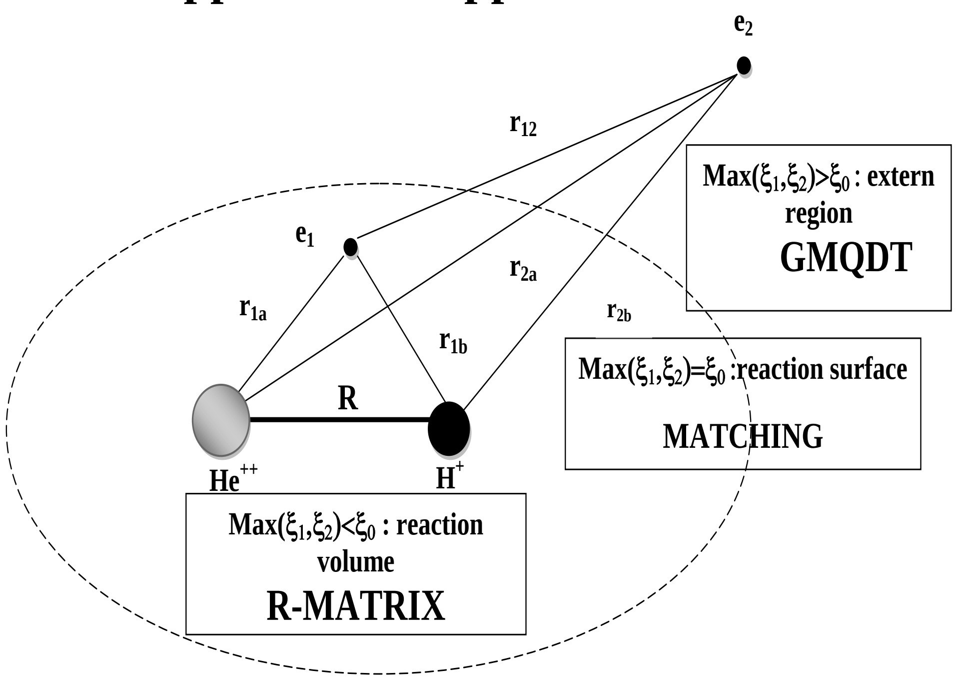
Soumaya Bezzaouia

Mourad Telmini

Christian Jungen

Presented by: Islem Bouhali

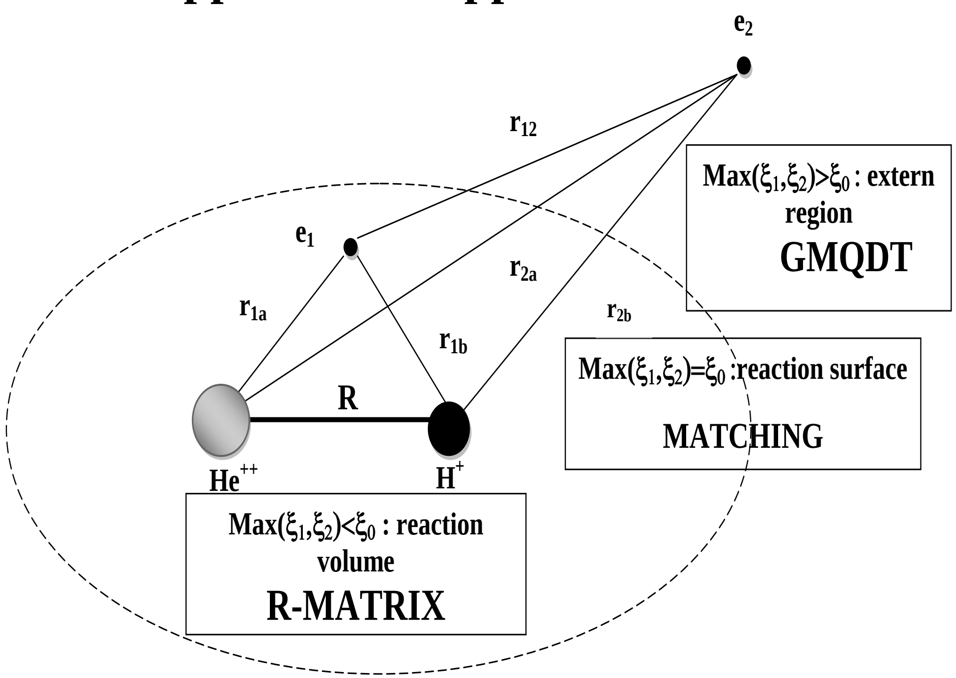
HeH^+ molecular ion in Born-Oppenheimer approximation



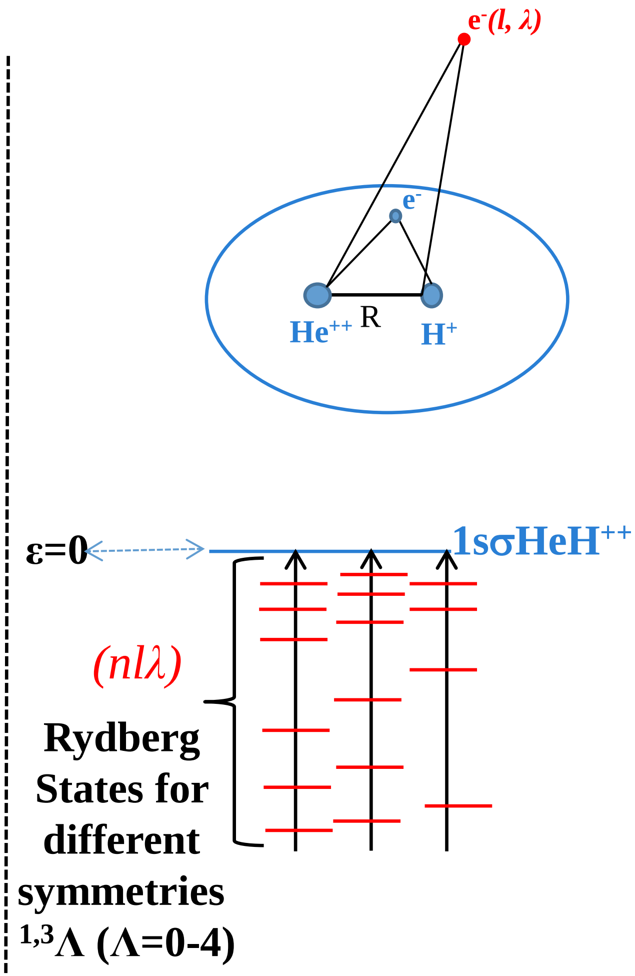
Combination of the Variational R-matrix method and of the Generalized Multichannel Quantum Defect Theory

Telmini and Jungen, Phys. Rev. A 68 062704 (2003).

HeH^+ molecular ion in Born-Oppenheimer approximation

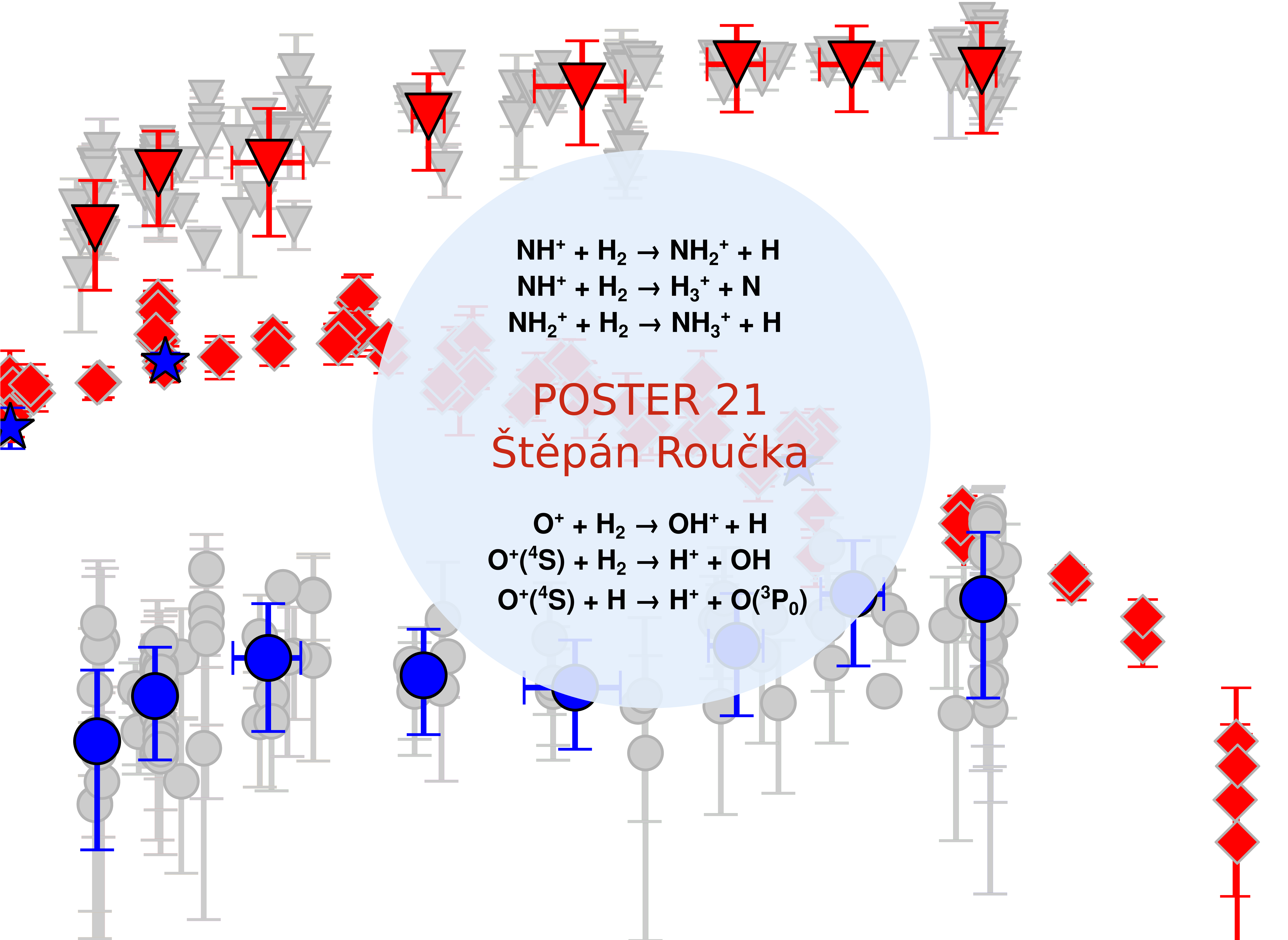


Combination of the Variational R-matrix method and of the Generalized Multichannel Quantum Defect Theory



$\Delta\nu = \nu[3] - \nu[2] = 0.0003$

[1] I. Bouhali, S. Bezzaouia, M. Telmini and Ch. Jungen, EPJ Web of Conferences. 84 04004 (2015).
[2] I. Bouhali, S. Bezzaouia, M. Telmini and Ch. Jungen, Phys. Rev. A, 94, 022516 (2016).
[3] M. Jungen and Ch. Jungen, Mol. Phys. 113, 2333 (2015).



$NH^+ + H_2 \rightarrow NH_2^+ + H$

$NH^+ + H_2 \rightarrow H_3^+ + N$

$NH_2^+ + H_2 \rightarrow NH_3^+ + H$

POSTER 21

Štěpán Roučka

$O^+ + H_2 \rightarrow OH^+ + H$

$O^+(^4S) + H_2 \rightarrow H^+ + OH$

$O^+(^4S) + H \rightarrow H^+ + O(^3P_0)$

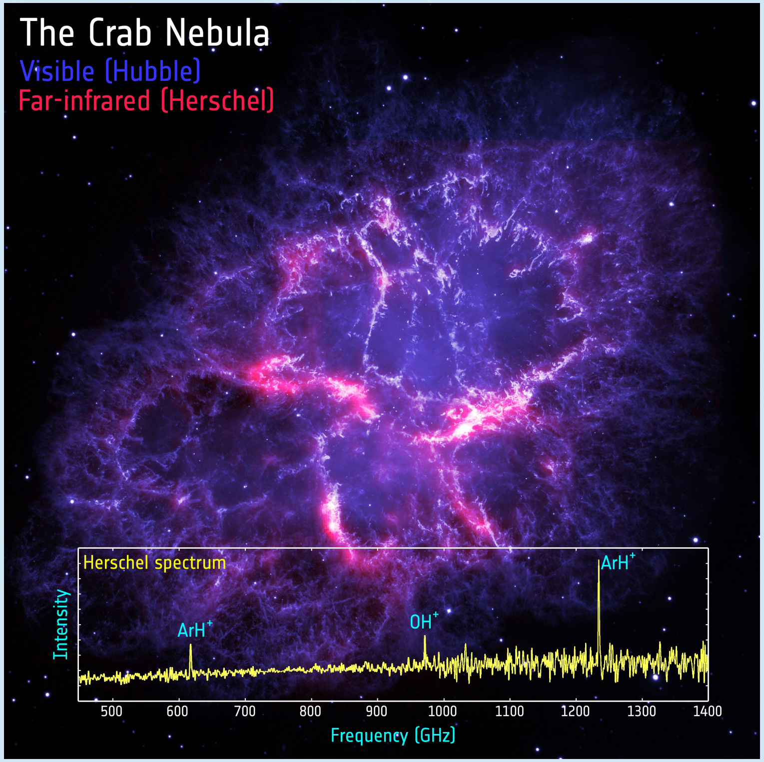
An investigation of the argonium emission from the Crab Nebula

Felix Priestley, Mike Barlow, Serena Viti
University College London

- Argonium (ArH^+) discovered in emission in Crab Nebula by Barlow et al. (2013), followed by detection in absorption in ISM by Schilke et al. (2014) and towards extragalactic sources by Müller et al. (2015).

- Interstellar ArH^+ requires low molecular hydrogen fraction to form, situation in Crab Nebula less clear due to X-ray synchrotron emission and probable high charged particle flux.

- Combination of photoionisation and photodissociation region modelling used to investigate molecular abundances in Crab Nebula knots/filaments, and compare predicted line emission to Herschel SPIRE FTS data.



Poster 23: Formation of Solid H_2-Bodies

H_2 Phase Transition + Gravity = Substellar H_2 Bodies

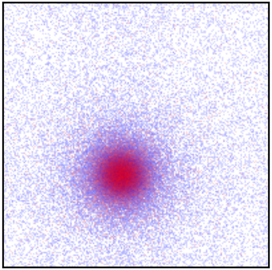
Motivation

- Formation of solid H_2
  - During star formation
  - In cometary knots
  - In cold disks
- Solid H_2 as dark baryons

Conclusions

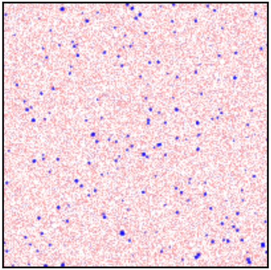
- Fluids in a phase transition
  - Always gravitationally unstable
  - Jeans length vanishes
- Phase transition + gravity:
  Gas → grains → planetoids

Ideal gas + gravity



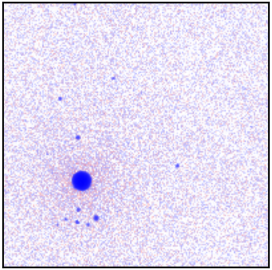
Formation of gaseous He-planetoid

Phase transition



Formation of solid H_2-oligomers

Phase transition + gravity

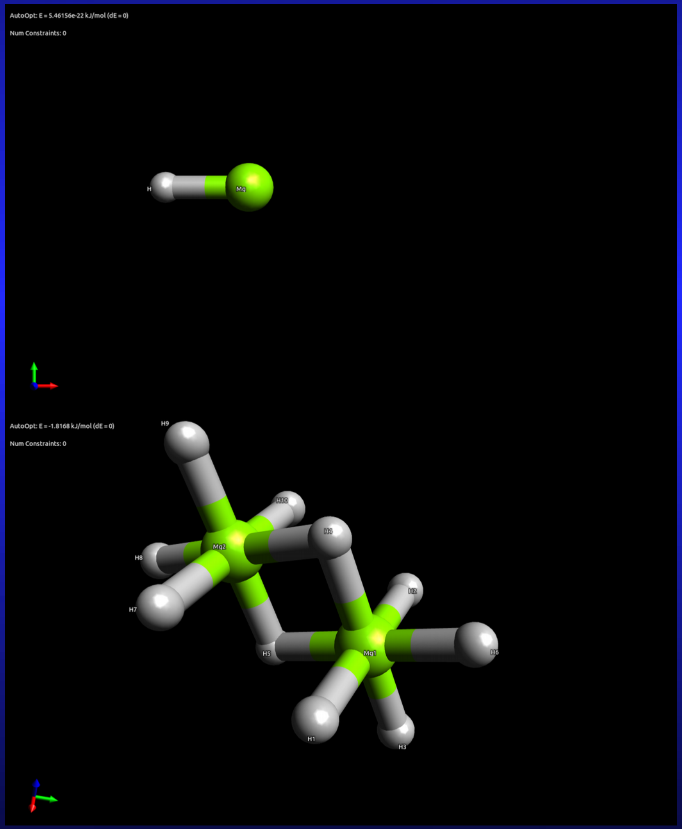


Formation of solid H_2-planetoid

Andreas Füglistaler & Daniel Pfenniger
Geneva Observatory, University of Geneva

MgH_2 in space and interaction with H

Carla Maria Coppola
Università degli Studi di Bari, Dipartimento di Chimica
Via Orabona 4, I-70126, Bari, Italy
carla.coppola@uniba.it



1- Thermochemistry

2- Electronic structure

3- Stability & chemical bonds

↓

MgH_2 vs MgH in cold ISM (?)

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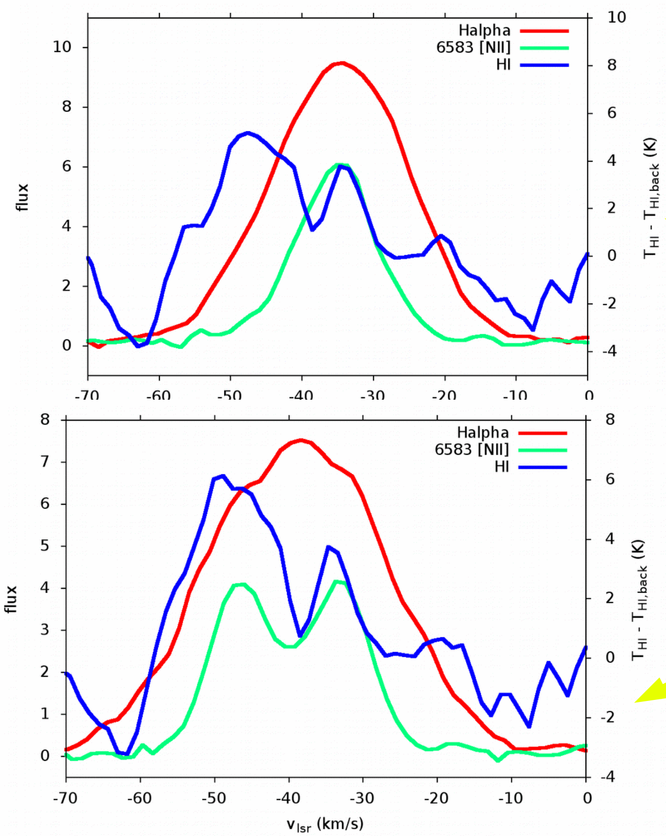
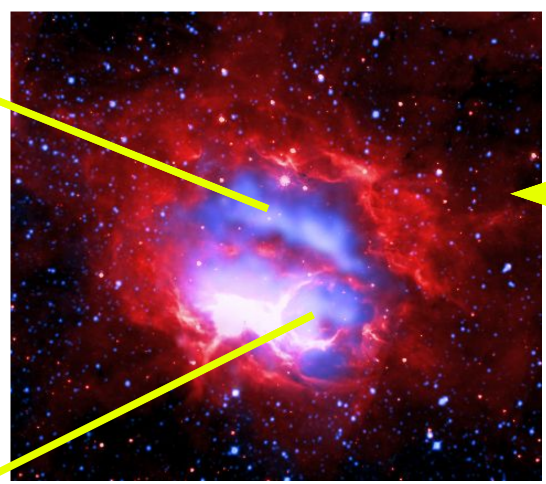
Optical observations of IR bubbles S73 and S74

Soňa Ehlerová[1] & **Lenka Zychová**[2]

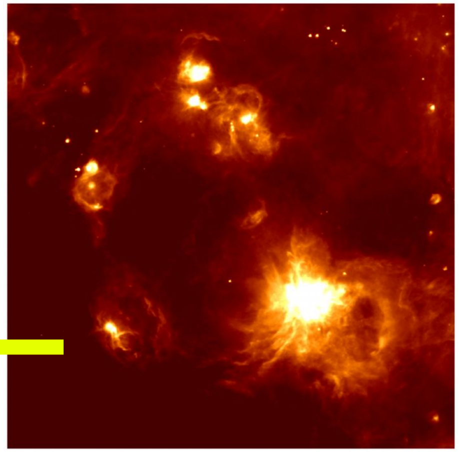
[1]Astronomical Institute, Czech Academy of Sciences
[2]Faculty of Science, Masaryk University, Brno



FOV: 16 x 13 arcmin
(12 x 10 pc at 2.61 kpc)



GLIMPSE + SuperCOSMOS



Herschel

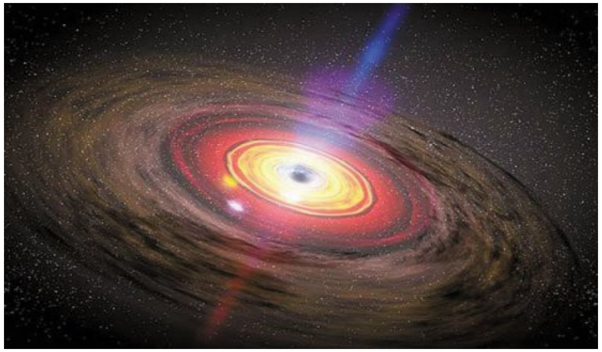
Spectra: 2.2m MPG/ESO, HI4PI

The Impetus project:

Using the supercomputer ABACUS for the HPC of Radiative Tables for accretion onto a galaxy Black Hole

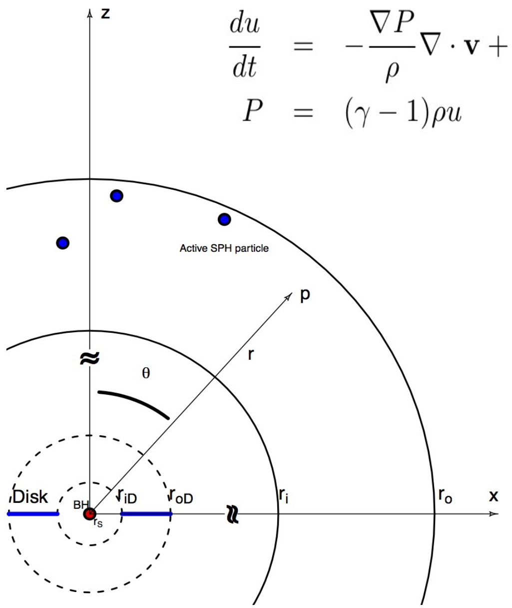
SMBH Disk Model:

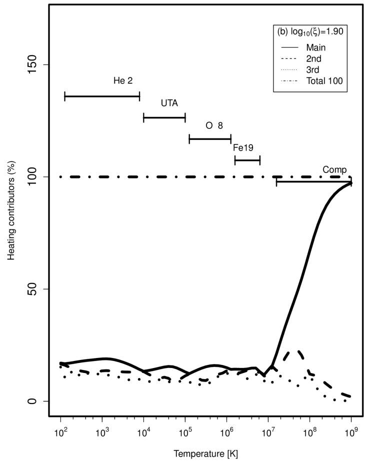
M_{BH} = 10^8 solar masses
R_{iD}= $3R_{Sch}$= $3*2GM_{BH}/c^2$
R_{oD}= $10R_{Sch}$
T= $1.3x10^5 – 4x10^5$ K
Initial SED for the disk

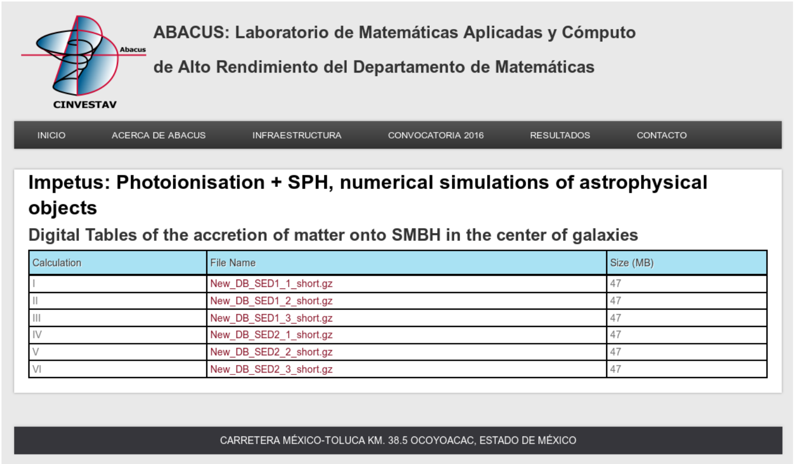


José M **Ramírez-Velasquez** (IVIC), Jaime Klapp (ININ), Ruslan Gabbasov (UAEH), Fidel Cruz (UAM-A), Leonardo Di G. Sigalotti (UAM-A)

$$
\begin{aligned}
\frac{d\rho}{dt} &+ \rho\nabla\cdot\mathbf{v} = 0 \\
\frac{d\mathbf{v}}{dt} &= -\frac{\nabla P}{\rho} + \mathbf{g}^{grav} + \mathbf{g}^{rad} \\
\frac{du}{dt} &= -\frac{\nabla P}{\rho}\nabla\cdot\mathbf{v} + \frac{\Gamma(u,\rho)-\Lambda(u,\rho)}{\rho} \\
P &= (\gamma-1)\rho u
\end{aligned}
$$



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Impetus: Photoionisation + SPH, numerical simulations of astrophysical objects

Digital Tables of the accretion of matter onto SMBH in the center of galaxies

Calculation	File Name	Size (MB)
I	New_DB_SED1_1_short.gz	47
II	New_DB_SED1_2_short.gz	47
III	New_DB_SED1_3_short.gz	47
IV	New_DB_SED2_1_short.gz	47
V	New_DB_SED2_2_short.gz	47
VI	New_DB_SED2_3_short.gz	47

CARRETERA MÉXICO-TOLUCA KM. 38.5 OCOYOACAC, ESTADO DE MÉXICO

http://www.abacus.cinvestav.mx/impetus

Ortho-para ratio of H_2O in molecular clouds: development of enrichment techniques to investigate the role of cold grains

T. Putaud, X. Michaut, M. Bertin, G. Féraud, R. Dupuy, P. Jeseck, L. Philippe, J.-H. Fillion and D. Lis

Objectives

Crédit : Spitzer-Nasa

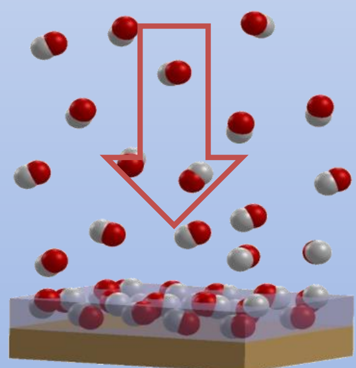
X. Michaut
D. Lis
M. Gerin
J. Goicoechea ICCM
B. Godard
F. Le Petit

Feasability studies

Ice sample preparation
Enriched in ortho H_2O:
- by optical pumping

LERMA

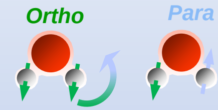
- with magnetic lenses:



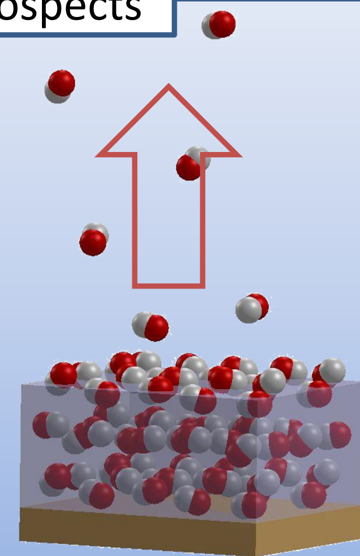
ice

substrate T<20 K

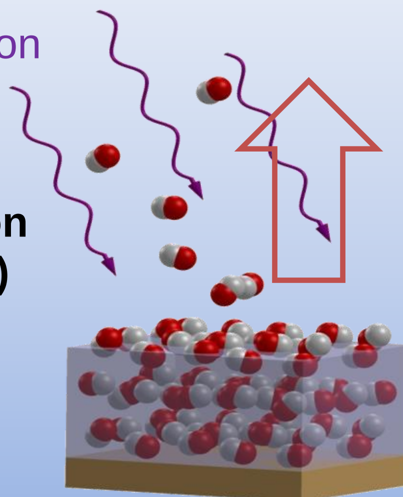
Prospects



thermal desorption

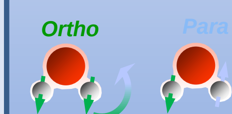


VUV radiation



UV desorption (non thermal)

SPICES 2



COMPLETE HYDROGENATION OF A PAH CATION

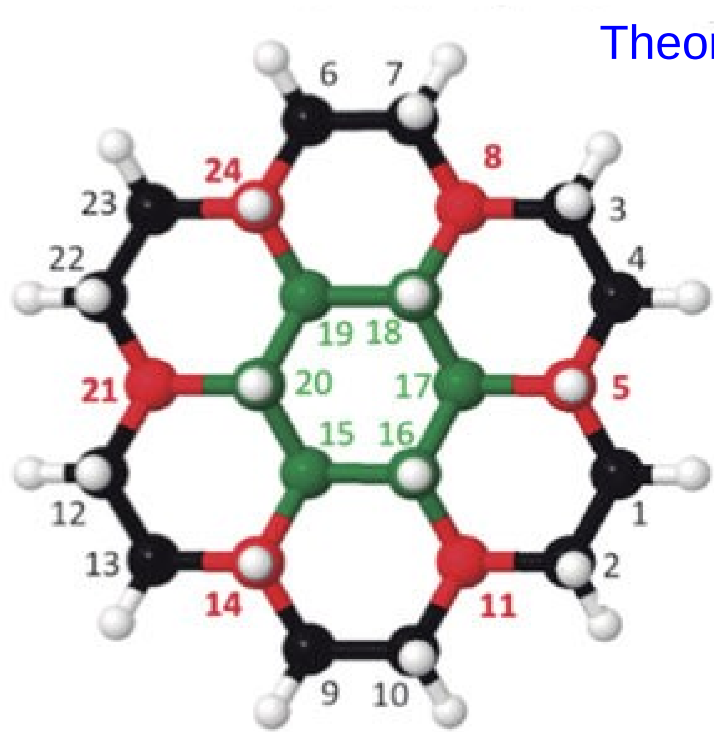
S. Cazaux[1,2], L. Boschman[1,3], N. Rougeau[4], G. Reitsma[3], R. Hoekstra[3,5], D. Teillet-Billy[4], S. Morisset[4] , M. Spaans[1], and T. Schlathölter[3]

(1) Kapteyn Astronomical Institute, University of Groningen, P.O. Box 800, NL 9700 AV Groningen, The Netherlands.
(2)Leiden Observatory, Leiden University, P.O. Box 9513, NL 2300 RA Leiden, The Netherlands.
(3)Zernike Institute for Advanced Materials, University of Groningen, Nijenborgh 4, 9747AG Groningen, The Netherlands.
(4)Institut des Sciences Moléculaires d'Orsay, CNRS, Univ Paris-Sud, Université Paris Saclay, F-91405 Orsay, France.

Astrophysical context

$PAH^+ = C_{24}H_{12}^+$

$C_{24}H_{36}^+$?



Theoretical Calculations / Experiments

Binding energies ?

Hydrogenation barriers ?

Hydrogenation sequence ?

+5H +11H et +17H more stable ?

Institut des sciences moléculaires d'Orsay

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