



MARIO ACCOLLA

Osservatorio Astrofisico di Catania



Formation of Silicate Dust Grains under Laboratory Conditions Mimicking the Atmosphere of Evolved Stars



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SCIENTIFIC FRAMEWORK

Understanding the formation mechanism of cosmic dust grains by means of laboratory simulation



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SPECIFIC AIM

Laboratory synthesis of olivines and pyroxenes under conditions similar to those of the atmospheres of oxygen-rich evolved stars (gas-phase reactions between atomic Si, Mg, and Fe under a controlled oxygen-rich atmosphere)



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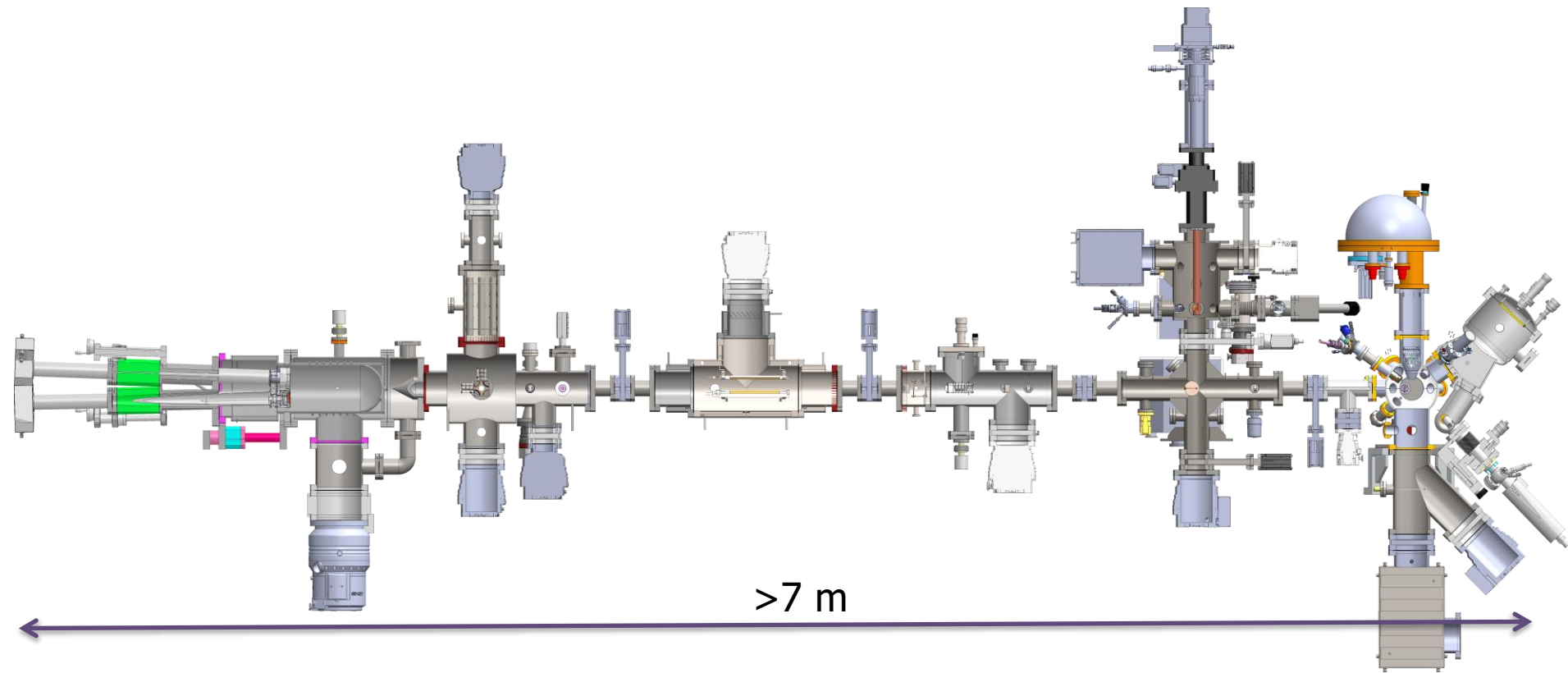
HOW?

Stardust machine (at "Instituto de Ciencia de Materiales de Madrid" – Spain)

Stardust machine

Designed to simulate in the laboratory:

- the complex condition of cosmic dust formation (dust formation proceeds via atom aggregation)
- the processing in the environment of evolved stars and ISM

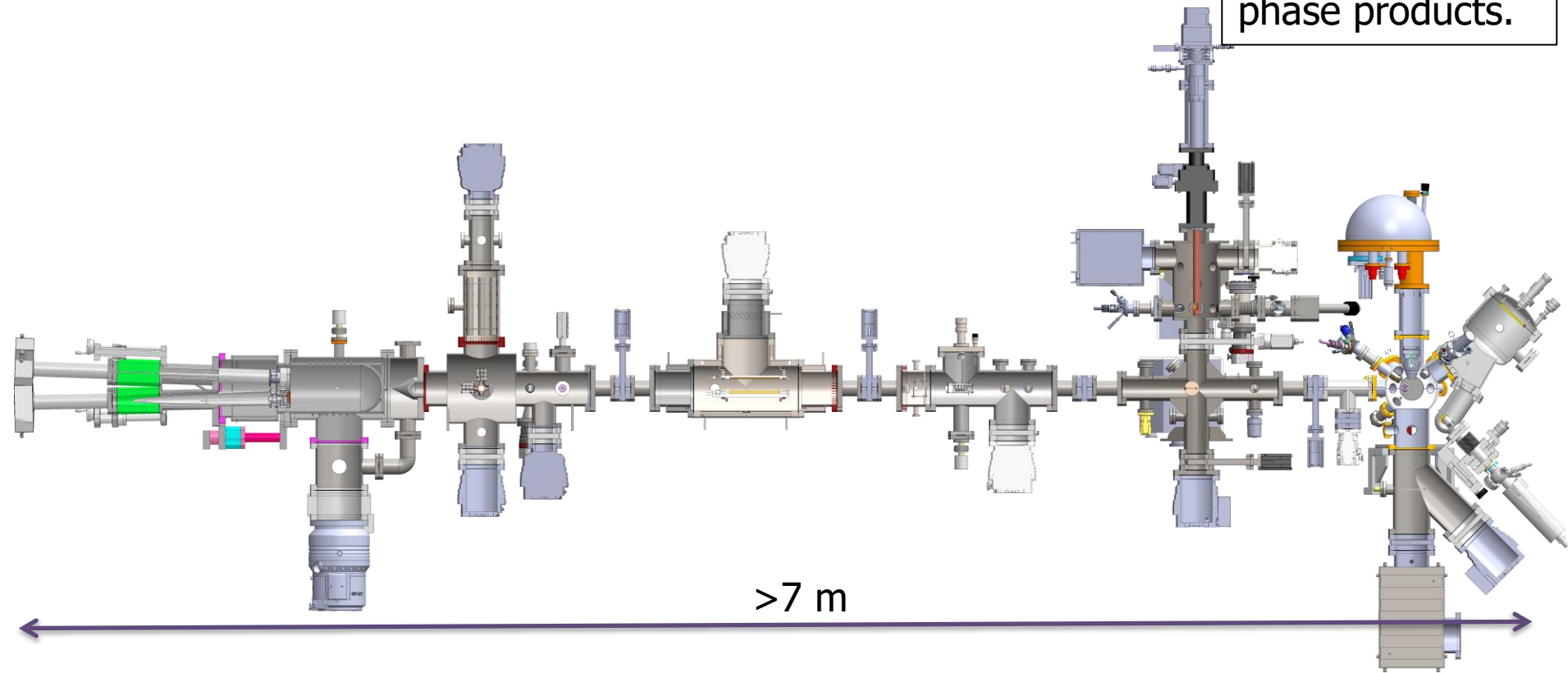


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It is equipped with a battery of in-situ and ex-situ diagnostic techniques useful for characterizing both the gas-phase and solid-phase products.



Stardust machine

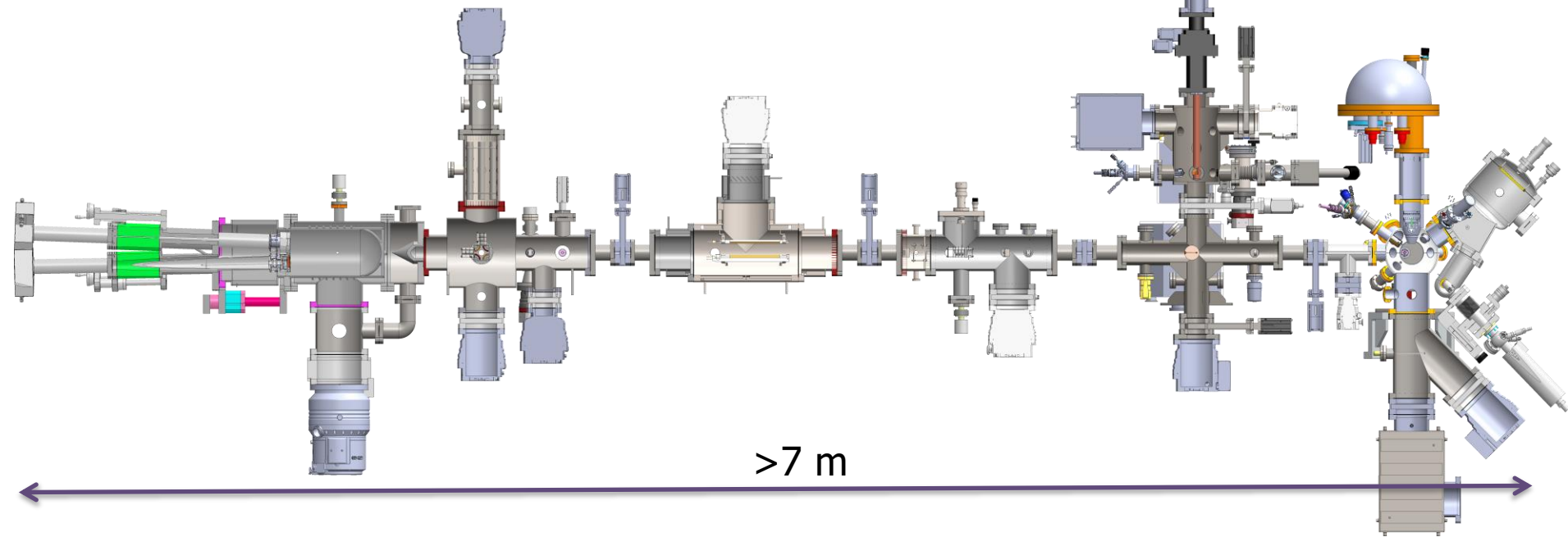
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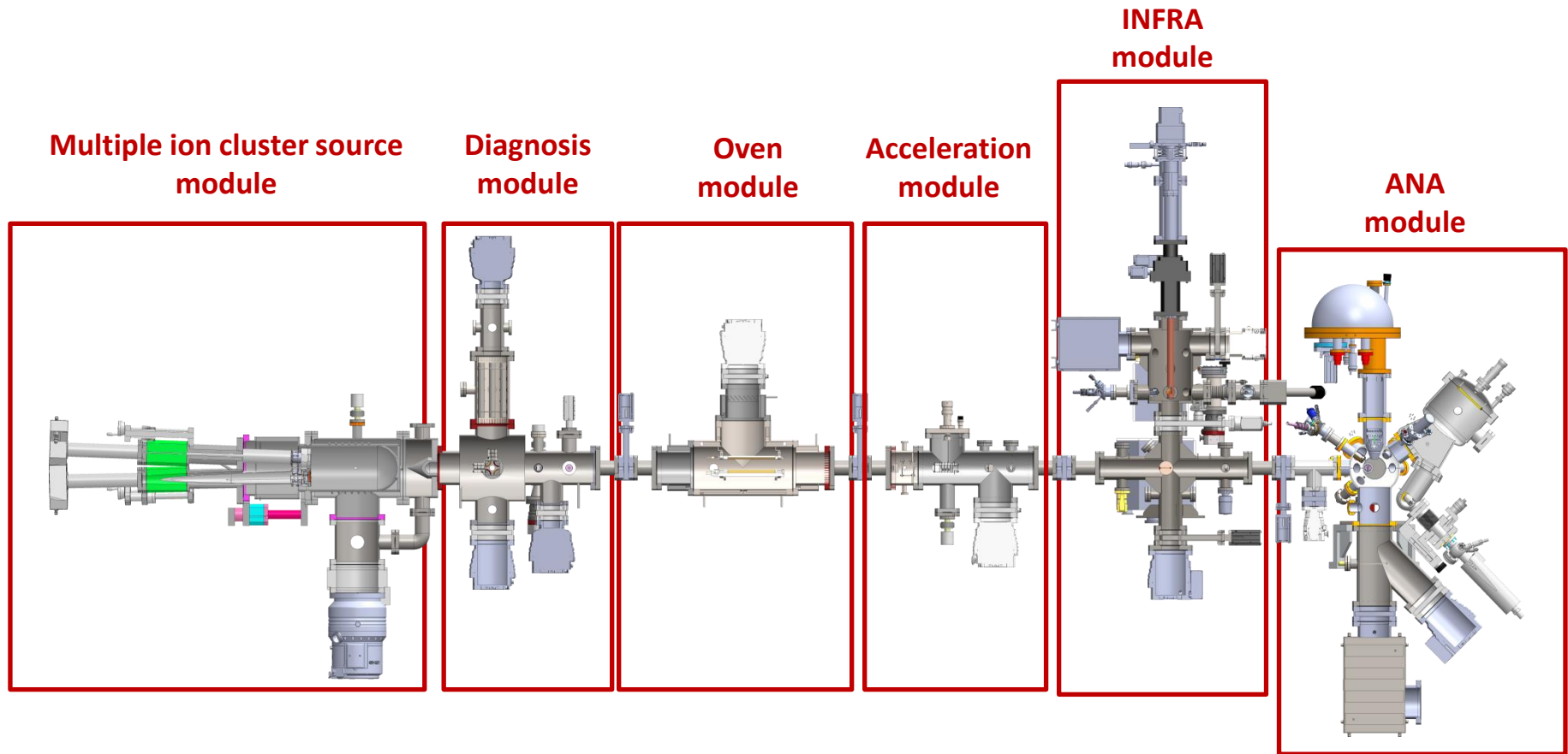
Stardust machine now is a facility!

**You can ask access time to perform your experiments
(details during the coffee-break!)**

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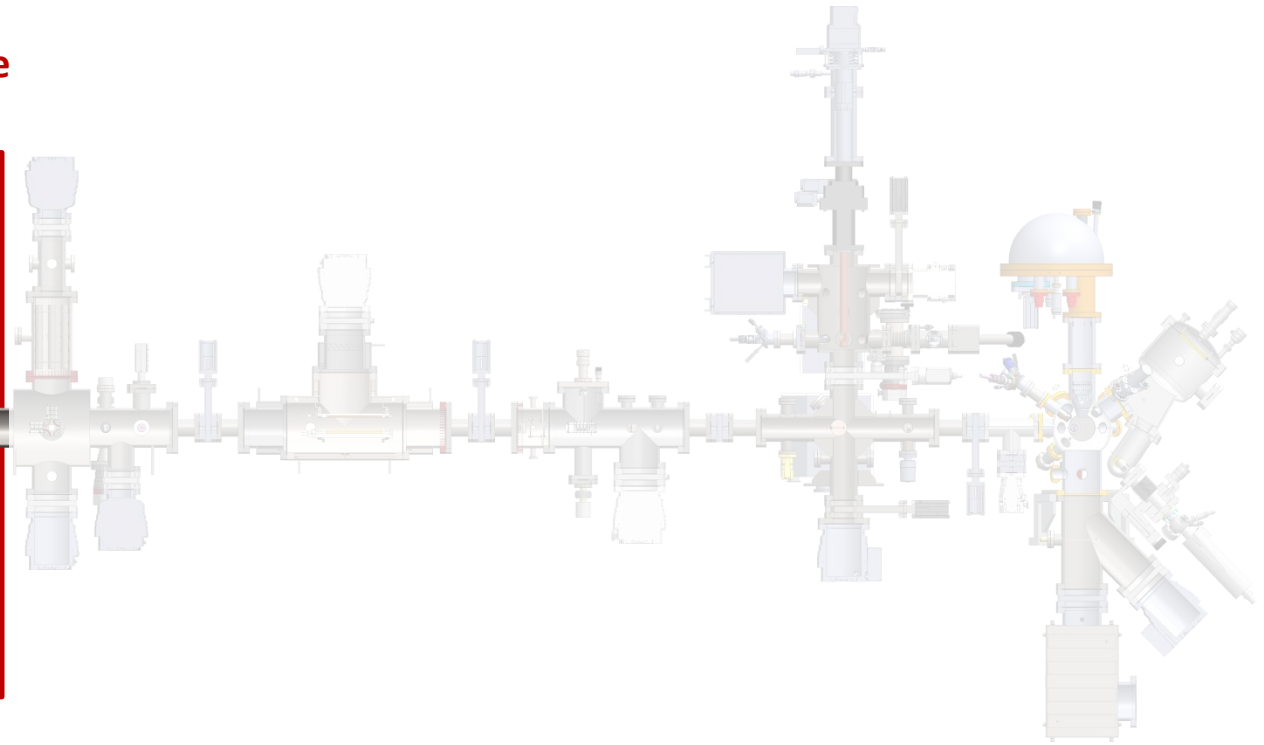
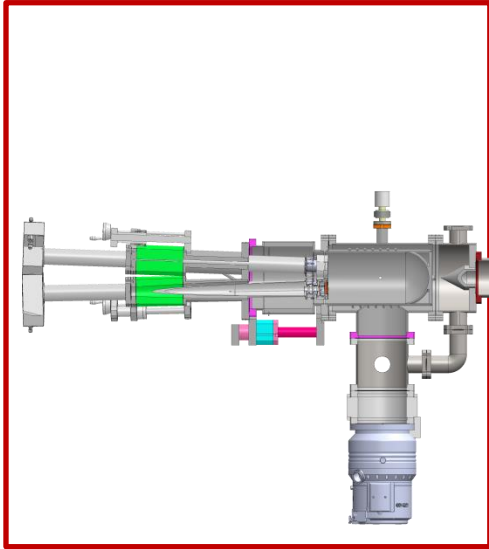
Stardust machine



- Composed by six different UHV modules, adaptable to different kind of experiments
- Some of these modules (INFRA or ANA) can work independently

Stardust machine – Dust nucleation module

Multiple Ion Cluster Source module

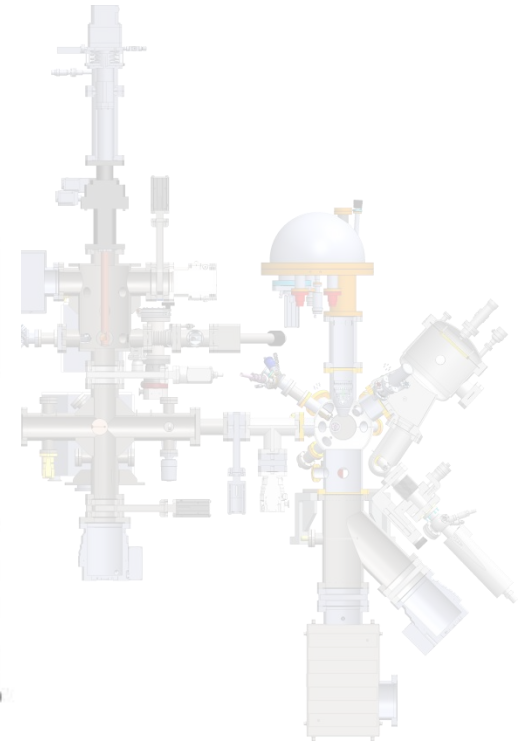
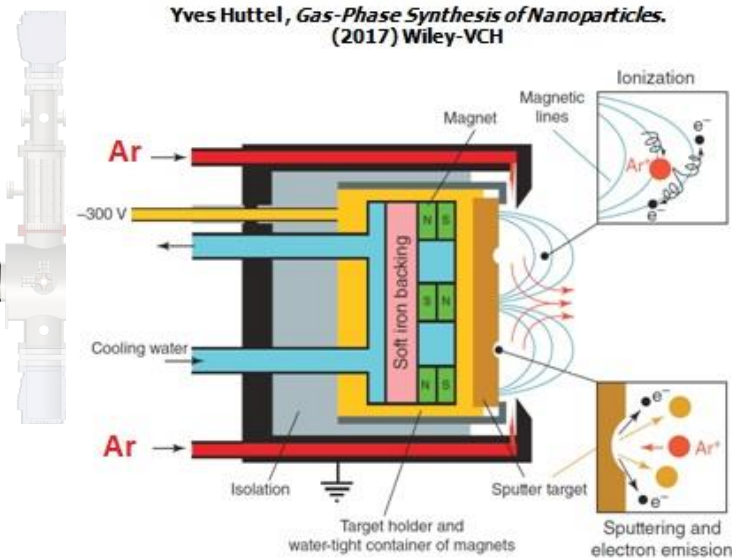
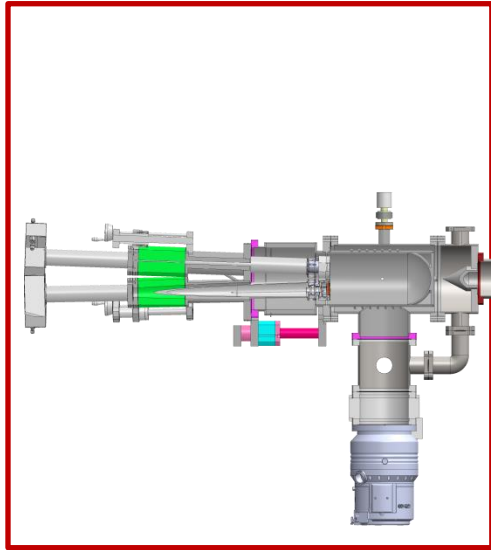


➤ Magnetron sputter source --> cluster and nanoparticle fabrication

(more details can be found in: Y. Huttel, *Gas-Phase Synthesis of Nanoparticles*, 2017, Wiley-VCH)

Stardust machine – Dust nucleation module

Multiple Ion Cluster Source module

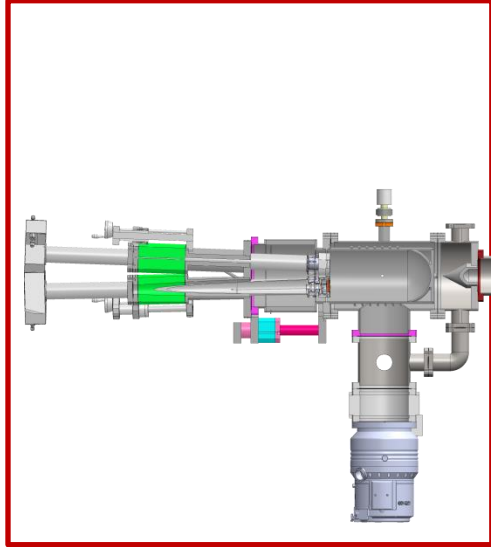


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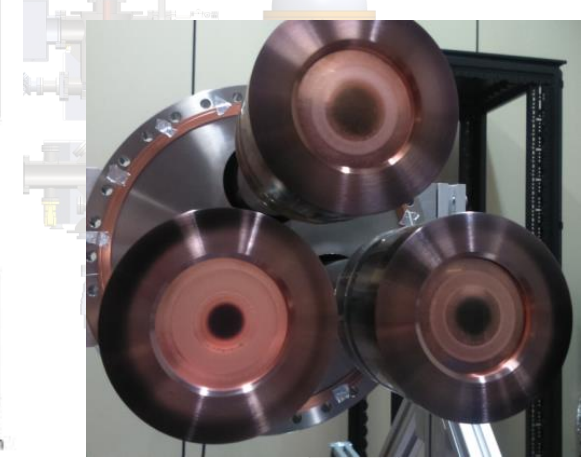
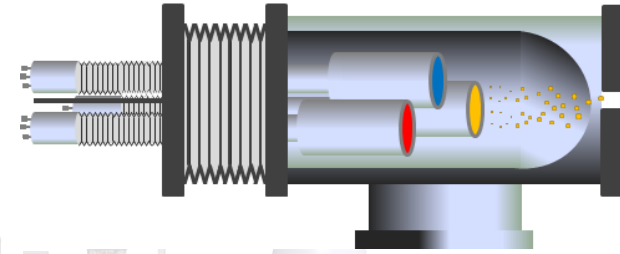
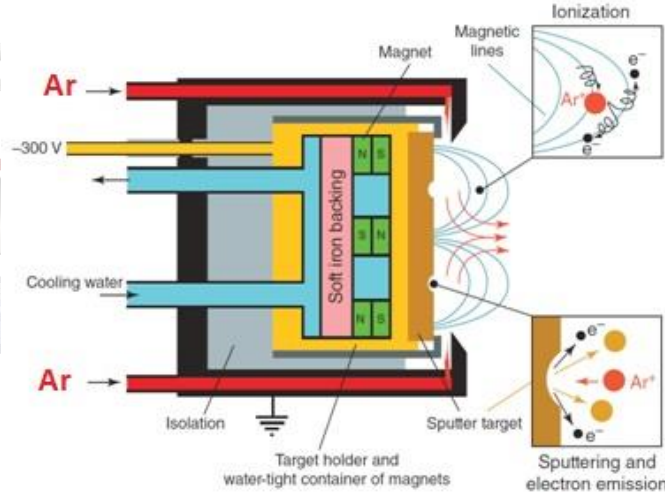
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Stardust machine – Dust nucleation module

Multiple Ion Cluster Source module



Yves Huttel, *Gas-Phase Synthesis of Nanoparticles*.
(2017) Wiley-VCH



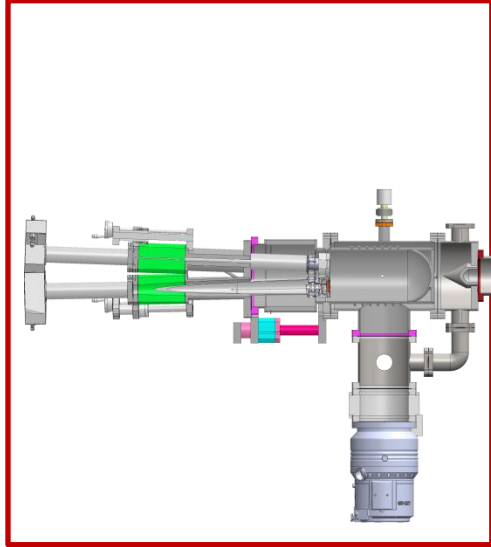
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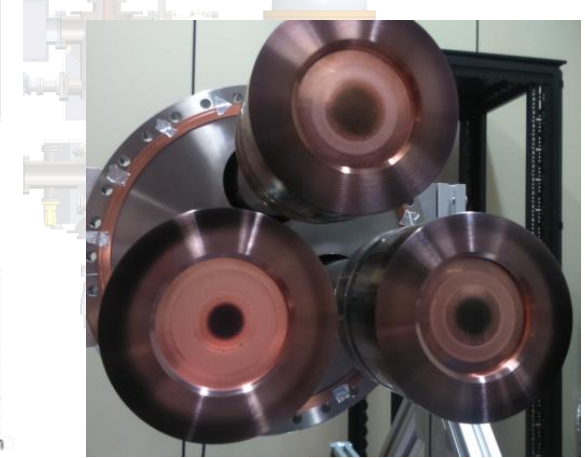
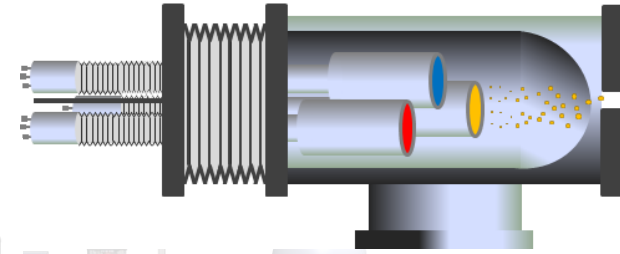
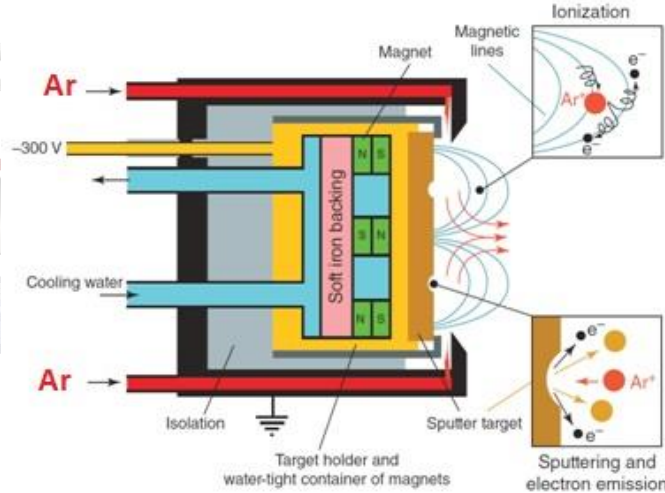
- Composed by three independent magnetrons

Stardust machine – Dust nucleation module

Multiple Ion Cluster Source module



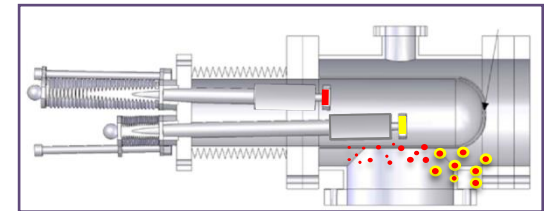
Yves Huttel, *Gas-Phase Synthesis of Nanoparticles*. (2017) Wiley-VCH



- Magnetron sputter source --> cluster and nanoparticle fabrication

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- Composed by three independent magnetrons
- Sputter target: graphite, silicon, metals, etc.





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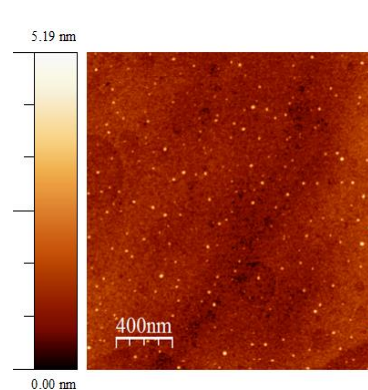
Formation of Silicate Dust Grains under Laboratory Conditions Mimicking the Atmosphere of Evolved Stars

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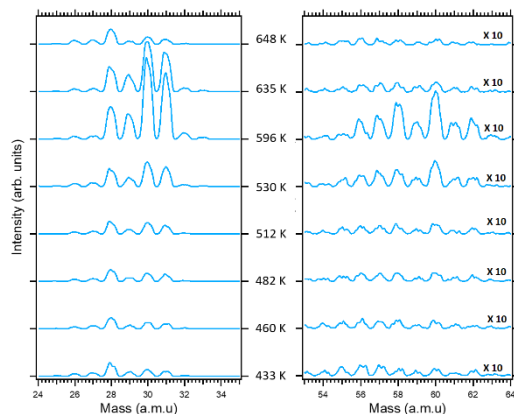


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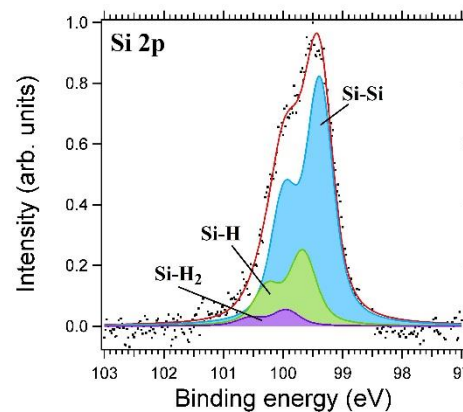
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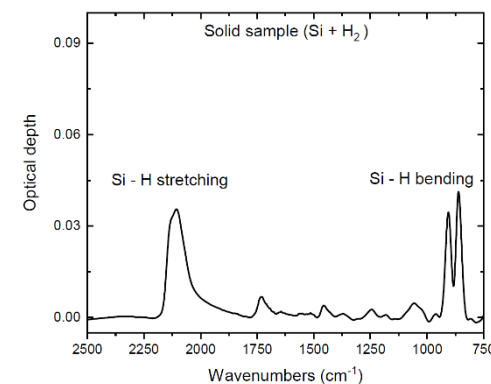
AFM



TPD



XPS



FTIR



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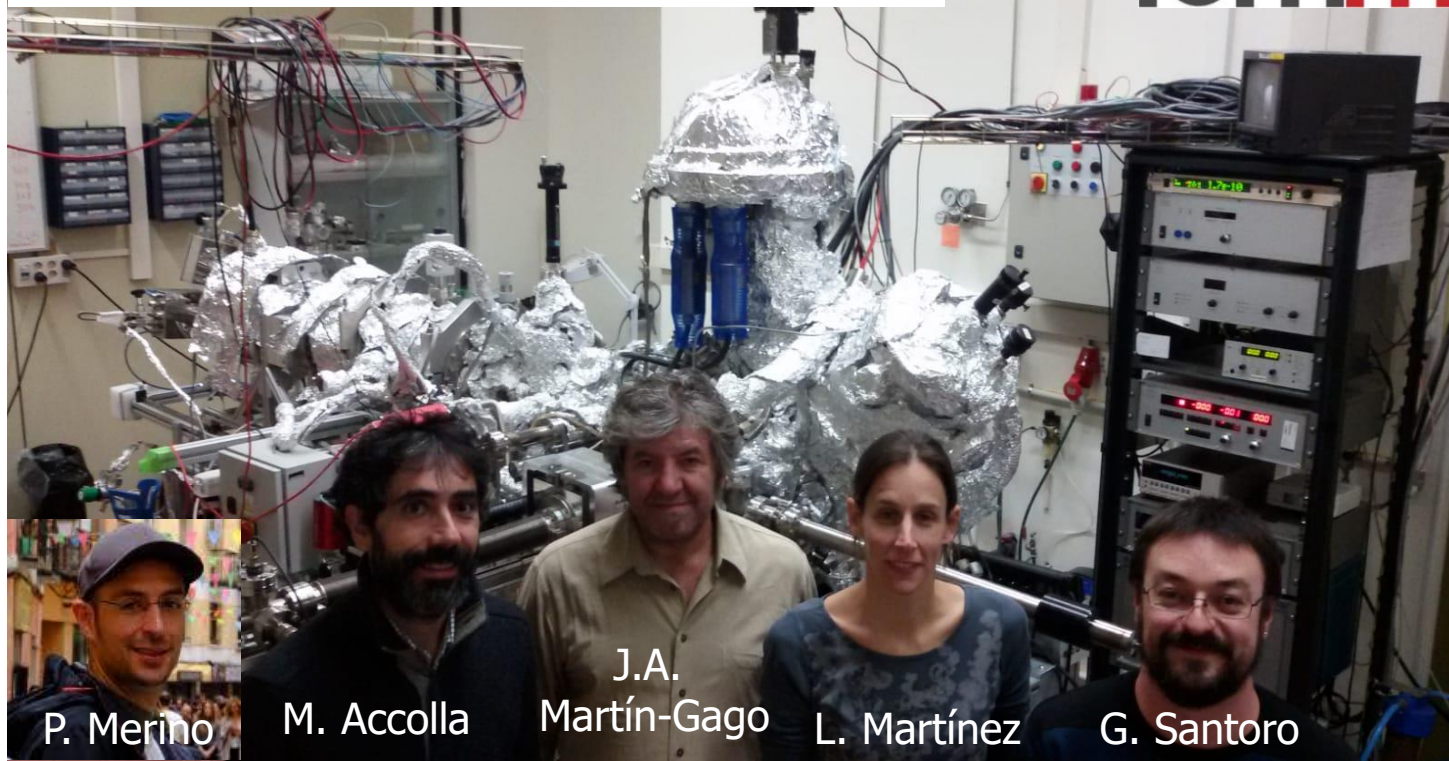
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- The present project has been conceived as a natural continuation of my previous works



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THANK YOU FOR YOUR ATTENTION!

icmm



P. Merino

M. Accolla

J.A.
Martín-Gago

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G. Santoro

