

## Recent Progress in Laboratory Astrophysics and Astrochemistry achieved with the COSmIC Facility

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We describe the characteristics and the capabilities of the laboratory facility, COSmIC, that was developed at NASA Ames to generate, process and analyze interstellar, circumstellar and planetary analogs in the laboratory<sup>[1]</sup>. COSmIC stands for “Cosmic Simulation Chamber” and is dedicated to the study of neutral and ionized molecules and nanoparticles under the low temperature and high vacuum conditions that are required to simulate various space environments such as diffuse interstellar clouds, circumstellar outflows and planetary atmospheres. COSmIC integrates a variety of state-of-the-art instruments that allow recreating simulated space conditions to generate, process and monitor cosmic analogs in the laboratory. The COSmIC experimental setup is composed of a Pulsed Discharge Nozzle (PDN) expansion, that generates a plasma in the stream of a free supersonic jet expansion, coupled to high-sensitivity, complementary *in situ* diagnostics: cavity ring down spectroscopy (CRDS<sup>[2]</sup>) and laser induced fluorescence (LIF<sup>[3]</sup>) systems for photonic detection, and Reflectron Time-Of-Flight Mass Spectrometer (ReTOF-MS) for mass detection<sup>[4]</sup>.

Recent results obtained using COSmIC will be highlighted. In particular, the progress that has been achieved in the domain of the diffuse interstellar bands (DIBs) [5] and in monitoring, in the laboratory, the formation of circumstellar dust grains [6] and planetary atmosphere aerosols [7, 8] from their gas-phase molecular precursors. Plans for future laboratory experiments on interstellar and planetary molecules and grains will also be addressed, as well as the implications of the studies underway for astronomical observations and past and future space mission data analysis.

### References:

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### The NASA Ames Cosmic Simulation Chamber:

