Inventory of experimental and theoretical resources available for NanoSpace COST Action	
Country:	Germany
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Short description of available techniques (experiment or theory):	1) **A gas-phase condensation setup** to study the condensation mechanism of cosmic dust grains and to produce layers of dust particles of different compositions including carbonaceous grains, silicates (pyroxenes, olivines), oxides, carbides, sulfides on different substrates that can be used as cosmic dust analogues. The thickness of the layers can be measured using a microbalance. The deposition chamber is connected to a FTIR spectrometer for in situ MIR spectroscopy and a cryostat. A co-deposition of dust with ice molecules at different temperatures is possible. In situ FTIR and UV/VIS spectroscopy provide quantitative spectral data in a very broad wavelength range. The morphology and internal structure of the grains are studied by electron microscopy (HRTEM and SEM) and therefore, well understood. 2) **Astrochemical reactions** in ices or ice/dust mixtures can be studied in an ultra-high vacuum chamber (10^{-10} mbar) equipped with a closed-cycle cryostat, which can cool down substrates to temperatures of less than 10 K. Energetic photons or reactive atoms are used to trigger reactions between molecular ice components or between the ice and the dust surface. Chemical reactions are monitored in situ by IR spectroscopy, temperature-programmed desorption, and mass spectrometry. 3) **Superfluid He droplets** at a temperature of 0.37 K can be used to study reactions between molecules and atoms under equilibrium conditions. Such He droplets can be produced by a special technique. The liquid He is able to absorb the energy of associative reactions allowing the modeling of reactions on the

	surface of dust particles. In addition, the liquid He droplet can be used as a nanocalorimeter. In case of a chemical reaction, the energy released during this reaction is transferred to the He droplet causing the evaporation of He atoms. The method can be used to study interstellar astrochemical reactions on the surface of dust or ice grains. Laser spectroscopy in the UV/VIS/NIR range of the species embedded inside the He droplets can be performed and the spectra can be compared with astrophysical observations.
Sample/target description (e.g. gas, clusters, solid,…):	Refractory nanoparticle agglomerates with fractal structures leading to a porous dust layer. Films of molecular ices. Films of molecular ices on nanoparticles. Nanoparticles/ice mixtures. Superfluid helium clusters doped with any species from the gas-phase.
How to access to experimental/computational resources	Collaboration
References **(max 5)**:	1) Jäger, C., Mutschke, H., Henning, Th., and Huisken, F., 2008, ApJ, 689, 249 2) Sabri, T., Gavilan, L., Jäger, C., et al. 2014, ApJ, 780, 180 3) Potapov, A., Jäger, C., Henning, T., 2019, ApJ, 880, 12 4) Henning, T. K., & Krasnokutski, S. A. 2019, Nat Astron, 3, 568