

Discipline	Research Cornerstone	Description	Science Targets	Potential Applications
Fundamental Physics	Complex plasmas and Dust Particle Physics	Understand the three dimensional behaviour of particles in Complex Plasmas and aggregation processes which require weightlessness.	Enhance theoretical description of complex plasmas, including self-ordering and phase transition phenomena. Improve modelling of the interaction of proto-planetesimals, their optical properties and of the behaviour of pollutants in the atmosphere.	Develop novel plasma coating techniques. Nucleation and growth of novel substances for solar cells and plasma screens. Improved modelling of Earth climate and environment.
	Cold Atoms and Quantum Fluids	Study properties and applications of cold atoms, including Bose-Einstein condensates.	Develop and operate a cold atom clock in space. Check limits of validity of theories of relativity and quantum electrodynamics.	Improved accuracy of absolute time measurements. Increased accuracy for navigation and geodesy systems.
Fluid and Combustion Physics	Structure and Dynamics of Fluids and Multiphase Systems	Study of Multiphase Systems, their phase transitions and related dynamics, critical and supercritical fluids, granular materials. Geophysical fluid flows.	Quantify heat transfer, mass exchange and chemical processes in multiphase systems and supercritical fluids. Measure diffusive processes in mixtures. Study the stability of foams and emulsions. Describe dynamic coupling in granular materials under vibration.	Develop reactors for supercritical oxidation of industrial contaminants. Develop high-efficiency heat exchangers. Improve reactor design in industrial plants. Design improved oil recovery techniques.
	Combustion	Study combustion phenomena that are dominated on the ground by buoyancy convection.	Quantify fuel droplet and spray evaporation, auto-ignition and combustion processes. Detail the process of soot formation in flames and the conditions for flammability of solid fuels.	Improve efficiency of electrical power plants. Reduce emissions of engines. Improved flammability test procedures.