

Abstract - Student Spaceflight Experiments Program Mission 21:

This year, LoCSST partnered with the UML Space Club (USC) to establish a local community of the Student Spaceflight Experiments Program (SSEP), run by the National Center for Earth and Space Science Education (NCESSSE). Designed to mirror professional scientific research, the program engaged 27 undergraduate students across 11 teams in proposal development, competing for a single opportunity to fly an experiment aboard the International Space Station (ISS). In alignment with USC's mission, projects emphasized space as a resource for humanity, including expanded human presence and low-gravity manufacturing. Three finalist teams investigated gravity's effects on yeast fermentation, metal-organic frameworks, and casein protein colloid formation. NCESSSE selected the casein colloid experiment to be launched to the ISS in June. This study examines how microgravity influences the stability and aggregation of casein micelles, which control the texture and structure of dairy products. On Earth, gravity accelerates creaming and sedimentation, leading to aggregation and nonuniform textures; in microgravity, these effects are suppressed, allowing micelle aging to be driven solely by diffusion and intermolecular forces. The experiment will use a Type 3 Fluids Mixing Enclosure (FME) containing a casein suspension, a phosphate buffer for pH control, and an ethanol fixative. These components will be mixed sequentially by an astronaut to initiate and preserve micelle evolution. After return, particle size, turbidity, and texture will be analyzed and compared to ground controls. The results will advance understanding of colloidal aging and inform the development of stable dairy-based foods for future space missions. The selected team, with support from other USC members, is currently refining the experiment and conducting ground control tests in preparation for NASA flight safety review.