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Small Space Science Missions (2)

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A LABORATORY FOR THE RAPID DEVELOPMENT OF SMALL SCIENCE MISSIONS

Abstract

How did the universe develop from an infinitely small point into the vast structures that we observe today? How did a cloud of gas and rubble evolve into our solar system? What were the conditions necessary for life to evolve? These are some of the questions that scientists of the DFG Cluster of Excellence ORIGINS, a German government-funded consortium comprising several renowned universities and research institutions, try to answer. They seek to understand the evolution of the universe and the formation of the structures within it, bridging a range of disciplines from astrophysics all the way to biochemistry. Until recently, most astrophysics investigations that required space-based instruments relied on traditional, large satellites. In the past decade or so, however, the use of small satellites has moved beyond mere educational purposes to the point where they can now genuinely complement big-budget science missions. This allows scientists to conduct a multitude of science and demonstration missions that previously were unfeasible. To take advantage of these developments, the ORIGINS consortium has decided to establish a new laboratory dedicated to the rapid development of small science missions. Its goal is to develop a satellite bus that can support a variety of science missions with only minor adaptations to the satellite's core systems. In this contribution, we present the scientific objectives and instrumentation for the laboratory's two initial missions: ComPol, which will measure the spectrum and polarization of X-rays emitted by the Cygnus X-1 binary system using a new type of Compton polarimeter; and AFIS, which will determine the antimatter content of Earth's Van Allen radiation belts to confirm and refine findings of the now-defunct PAMELA instrument. We describe the current development status and the results of instrument prototype tests. We also present the satellite bus we design to support these missions and give an overview of its capabilities and flight heritage.