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STABLE OPTICAL AND VACUUM SYSTEMS FOR QUANTUM TECHNOLOGY APPLICATIONS IN SPACE

Abstract

Space-based quantum technology applications face harsh mechanical and thermal stability requirements while making high demands on system size and mass. We have developed a technology for highly robust and miniaturized optical systems that overcomes these hurdles and that we are currently expanding to include vacuum systems. Our Zerodur based optical bench system allows the assembly of stable fiber-coupled modules for various applications [1]. Suitability of the technology has been demonstrated in the successful sounding rocket missions FOKUS [2], KALEXUS [3] and MAIUS-1 [4].

I will present the fundamentals of our technology and the optical modules of MAIUS-2 as an example application. MAIUS-2 is a quantum gas experiment performing atom interferometry with Bose-Einstein condensates of potassium and rubidium onboard a sounding rocket. The optical modules fulfill a whole range of functions such as laser frequency stabilization, switching and distribution of laser beams. Furthermore, I will discuss current efforts to build Zerodur based vacuum systems. The miniaturization of the chamber in conjunction with our laser system technology allows the development of highly robust and fully integrated quantum optical systems for space and other field applications.

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