

Piezoelectrically Actuated Shutter for High Vacuum

This vacuum-compatible shutter generates an acceptably small magnetic field.

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A piezoelectrically actuated shutter is undergoing development for use in experiments on laser cooling of atoms. The shutter is required to be compatible with ultrahigh vacuum [pressure of 10^{-9} torr

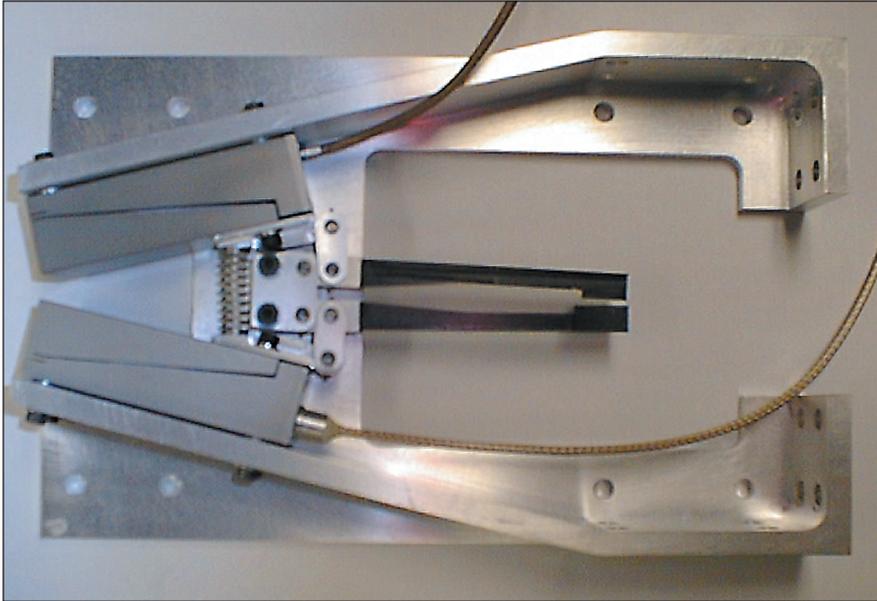
($\approx 1.3 \times 10^{-7}$ Pa) or less] and to be capable of performing reliably in the vacuum for at least one year. In operation, the shutter would enable the collection and launch of successive samples of cold atoms and

would enable the interrogation of the immediately preceding sample while preventing disturbance of the atoms of that sample by light from the collection region.

A major constraint is imposed on the design and operation of the shutter by a requirement that it not generate a magnetic field large enough to perturb an atomic clock. An electromagnetically actuated shutter could satisfy all requirements except this one. Hence, it was decided to use piezoelectric instead of electromagnetic actuation.

The shutter (see figure) includes two commercial piezoelectrically driven flexure stages that produce a travel of 0.5 mm. Levers mechanically amplify the travel to the required level of 1 cm. Problems that remained to be addressed at the time of reporting the information for this article included lifetime testing and correction of a tendency for shutter blades to bounce open.

This work was done by Robert Thompson and Gerhard Klose of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-30397



This is a **Prototype of the Shutter** under development for use in experiments on laser cooling of atoms.