

Press Release

August 25th, 2026 Page 1 | 3

Measuring Gravity with Drones

From Lab into the Air: Palm-Sized Glass Bench Makes Atom Gravimeters Mobile

Fraunhofer IZM and quantum tech company Nomad Atomics are teaming up on QuoGkA, a research project developing a compact atom gravimeter that will, in the future, measure gravitational fields from the air. The goal: shrink measurement systems that have always been stuck in the lab down to a size that fits comfortably on a drone. The breakthrough making this possible is a highly integrated glass bench developed at Fraunhofer IZM, which packs the key optical components and a rubidium gas cell into a single unit. The result is precision gravity measurement that can finally leave the lab - opening up new possibilities in mining, environmental monitoring, and research.

Atom gravimeters measure gravitational fields with extreme precision using a technique called atom interferometry, where ultra-cold rubidium atoms act as quantum sensors. The alkali metal rubidium is particularly well suited to this method because it has an easily controllable laser transition, is already gaseous at room temperature, and can be cooled relatively easily. The atoms are chilled to the point where they start behaving like waves. Short laser pulses then split these "atom waves" apart, send them off in two directions, and bring them back together - the measured difference reveals the strength of gravity. Even the smallest changes in the gravitational field thus provide information about underground structures, enabling applications in raw material exploration, water management, and geophysical research.

Compact Quantum Sensing for Mobile Gravity Measurements

Until now, such systems have been large, heavy, and largely confined to laboratories. Commercial atom gravimeters can weigh well over 100 kilograms, making them unsuitable for mobile applications.

With QuoGkA («quantum sensing through optical integration for gravimetry with cold atoms»), researchers at the Fraunhofer Institute for Reliability and Microintegration IZM and project partner Nomad Atomics aim to drastically reduce the logistical effort involved - to the point where, in the future, these measurement systems could even be deployed on drones. This requires miniaturizing the optical systems and integrating them onto a shared platform - the central contribution made by Fraunhofer IZM.

Highly Integrated Glass Bench as Key Technology

At the heart of the work is the development of an electro-optical circuit board that combines optical and electrical functions on a shared glass platform. The optical components, previously built separately, are thus combined on an area of around 50 cm².

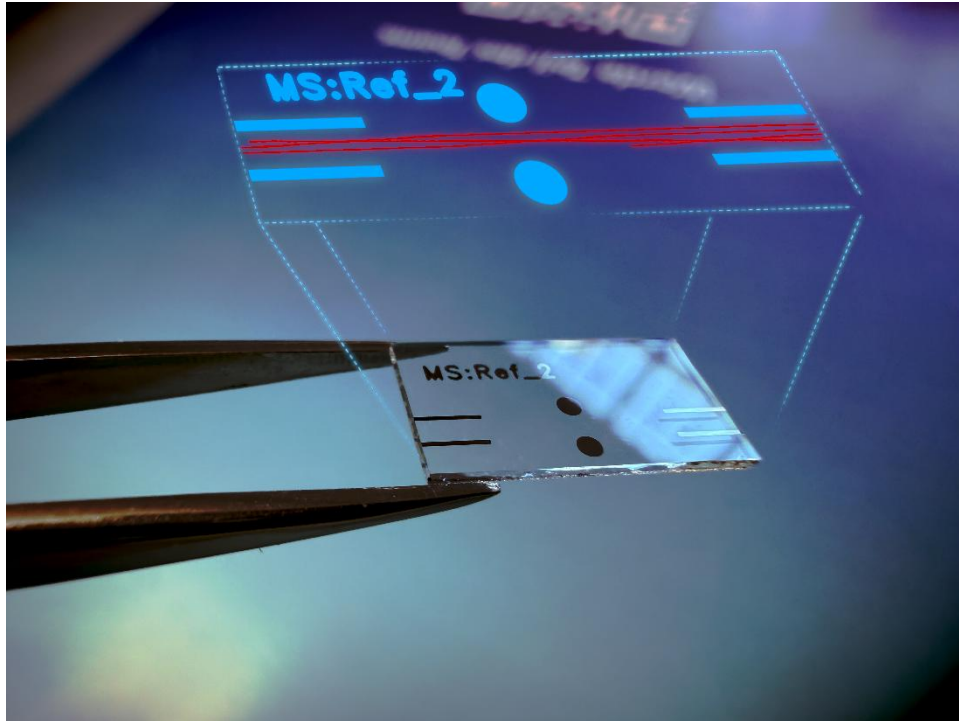
At its core are optical waveguides integrated into the glass, which guide the laser light precisely through the system. Thanks to the expertise at Fraunhofer IZM, this is achieved using a special ion-exchange process - a technology mastered by only a few research institutes and companies worldwide. Until now, such waveguides have primarily been used at a wavelength of 1,550 nanometers for telecommunications applications. Fraunhofer IZM researchers are now realizing, for the first time, single-mode waveguides with a target wavelength of 780 nanometers in an industrial process using commercial thin glass. This wavelength is needed to cool the rubidium atoms in a magneto-optical trap to temperatures close to absolute zero, making them usable for atom interferometry.

Key components include a multimode interference coupler and an evanescent coupler for precisely splitting the laser signals, as well as a 1-to-n switch based on an electro-optical polymer developed by the startup Hyphox. This switch enables the electrical distribution of the laser signal across one of four channels. In addition, project lead Jackson Kocis and his team are developing a rubidium gas cell made of glass, manufactured using a laser welding process, which integrates optical components for beam shaping alongside the hermetically sealed cell itself.

By combining these technologies, the Fraunhofer IZM scientists have created a highly integrated platform for quantum sensing. Thanks to their expertise, an expensive and heavy piece of laboratory equipment has been transformed into a highly integrated, lightweight system that can be manufactured industrially and deployed in the field. In doing so, they are making an important contribution toward making high-precision gravity measurements more flexible in the future - particularly in regions that have so far been difficult to access.

The QuoGkA project runs from 01.08.2024 to 31.07.2027 and is being carried out as part of the ProFit (IBB) funding program (funding reference 10206866). In addition to Fraunhofer IZM, the company Nomad Atomics is also involved.

(Text : Lotta Jahnke)



Optical fibers integrated into the glass guide the laser light precisely through the system. Evanescent couplers allow the light to be split in any desired manner.

© Photo: Fraunhofer IZM, Simulation: Jackson Kocis | Bild in Farbe und Druckqualität:
www.izm.fraunhofer.de/pics

The **Fraunhofer-Gesellschaft**, headquartered in Germany, is one of the world's leading organizations for applied research. Founded in 1949, the Fraunhofer-Gesellschaft currently operates 75 institutes and research units throughout Germany. Its nearly 32,000 employees, predominantly scientists and engineers, work with an annual business volume of 3.6 billion euros; 3.1 billion euros of this stems from contract research.

The **Fraunhofer Institute for Reliability and Microintegration IZM** is one of the world's premier research institutions for electronics packaging. With its dedication to developing miniaturized, high-reliability electronics in cutting-edge lab facilities, the institute works to maintain the competitive edge of Germany and Europe.

Contact

Technical contact

Julian Schwietering

Fraunhofer Institute for Reliability and
Microintegration IZM

Group Leader OIT

Phone +49 30 46403-731

julian.schwietering@izm.fraunhofer.de

Editorial contact

Georg Weigelt

Fraunhofer Institute for Reliability and
Microintegration IZM

Marketing & PR

Phone +49 30 46403-279

georg.weigelt@izm.fraunhofer.de

<https://www.izm.fraunhofer.de/>

