LICENSING OPPORTUNITY: SMART MIRROR

DESCRIPTION

Problem

The design overcomes the limitations of allowing simultaneous power measurement during laser use. The Smart Mirror's non-thermal approach reduces measurement time, allowing for better sensing of rapid changes in laser power.

Invention

The Smart Mirror is a device that accurately measures the power of laser sources without disturbing the laser beam. This is a promising technology for accurate monitoring of output power in industrial lasers that allows power measurement during the laser's performance of its routine operations. Such high-accuracy, non-exclusive power monitoring has not been previously possible. The novelty is in a radically different approach where the laser power is determined by measuring the force of the light as it reflects from a mirror. This device operates across a power range of 25W to 500W.

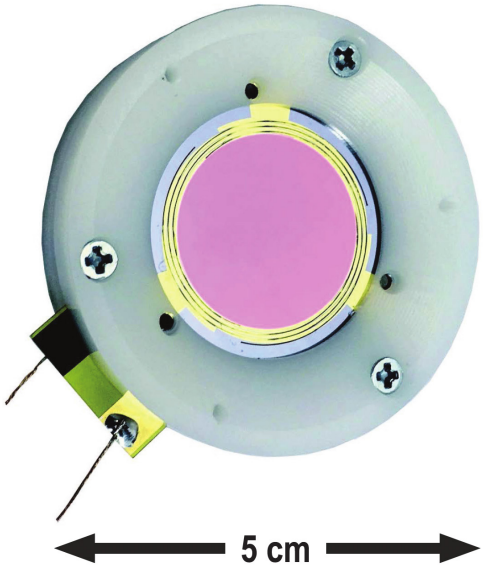
BENEFITS

Potential Commercial Applications

- Small, robust package for use on the factory floor.

Competitive Advantage

- This device is a miniaturized (less than 5 cm on a side), mirrored force sensor that combines several key elements to make the sensor smaller, faster, and more sensitive to force.
- Highly accurate measurements that can be made in real time.
- Can be calibrated in-house using standard reference masses.
- Does not absorb laser light.



A mounted pair of springs with high ref ectivity mirror designed for 1070 nm laser incident at 45 degrees.

Contact: licensing@nist.gov

NIST TECHNOLOGY PARTNERSHIPS OFFICE

NIST Technology Partnerships Office
National Institute of Standards and Technology
100 Bureau Drive, Gaithersburg, MD 20899-2200

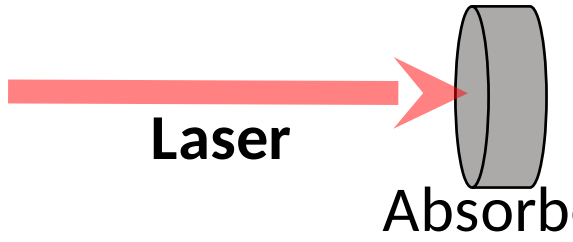
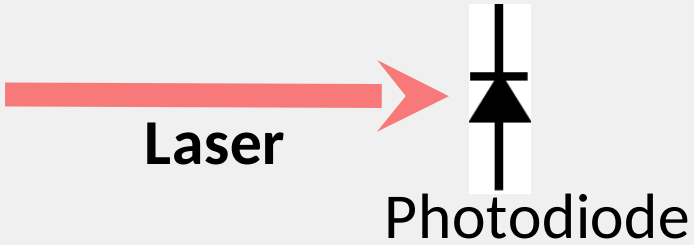
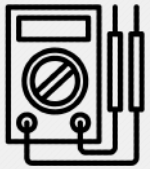
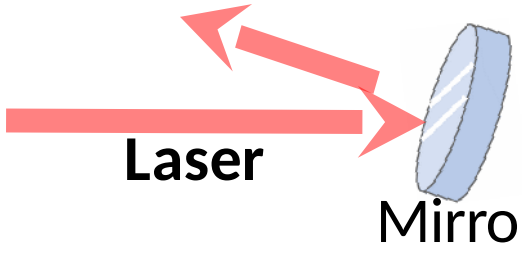
Meet **Paul Williams, Ph.D.,**

Physicist, National Institute of Standards and Technology

What If a Mirror Could Measure the Power of the Light It Reflects?

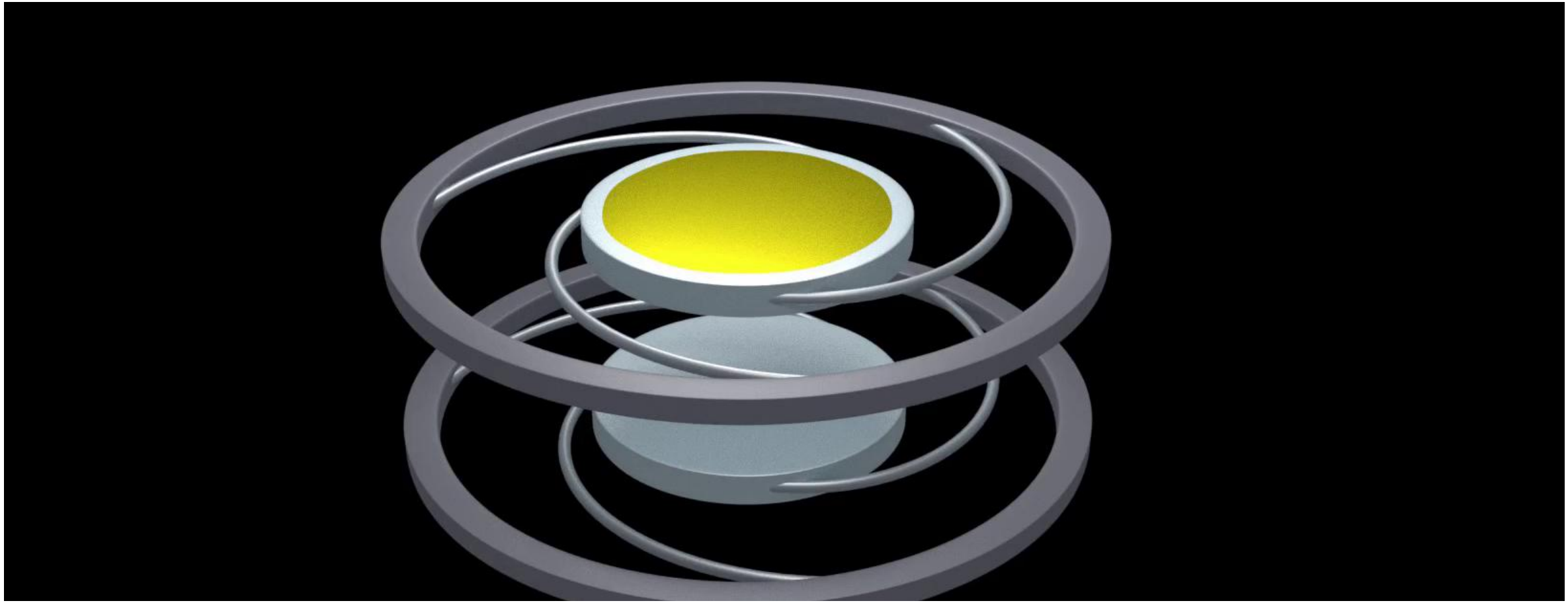
NIST National Institute of Standards and Technology U.S. Department of Commerce

Three Ways to Measure Laser Power

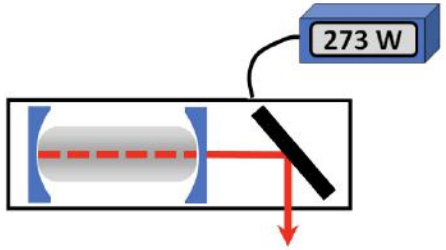
Technique	Sensor	Quantity
Thermal Power Meter		Temperature
Semiconductor (Photodiode)		Current / voltage 
Radiation Pressure Power Meter		Force

Smart Mirror

Radiation-Pressure-Based Power Sensor

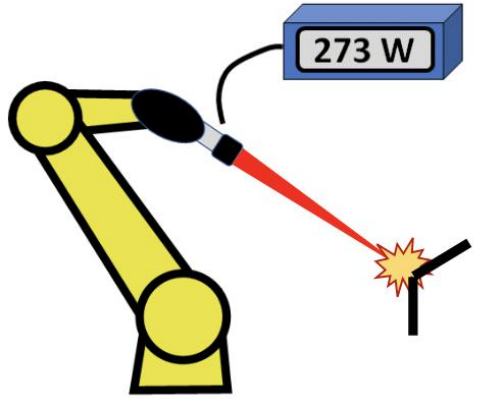


Smart Mirror: Sensor Element



Application

Calibrated Laser Source



Application

Laser-based Manufacturing: Real-time accurate laser power

The “Smart Mirror”: Non-invasively measuring laser power

Mechanisms:

- *Si-wafer mirror / spring suspension*
- *Interferometric (or capacitive) sensing*

Current Specifications:

- Power range: **25-500 W**
- Uncertainty: **3.2 %** (k=2)
- Noise equivalent power: **260 mW/√Hz**
- Vibration isolation: **15 dB**
- Technology readiness level: **4**

Reference:

A.B. Artusio-Glimpse, et al., *Optics Express*, **28**, 13310 (2020).

NIST National Institute of Standards and Technology U.S. Department of Commerce

LICENSING OPPORTUNITY

NIST NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY U.S. DEPARTMENT OF COMMERCE

THE SMART MIRROR

THE TECHNOLOGY

U.S. Patent Number 10,234,309

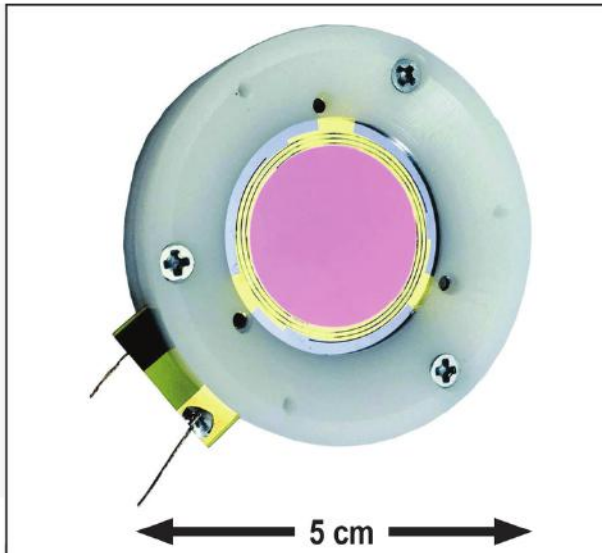
The Smart Mirror is a device that accurately measures the power of laser sources without disturbing the laser beam. This is a promising technology for accurate monitoring of output power in industrial lasers that allows power measurement during the laser's performance of its routine operations. Such high-accuracy, non-exclusive power monitoring has not been previously possible. The novelty is in a radically different approach where the laser power is determined by measuring the force of the light as it reflects from a mirror. This device operates across a power range of 25W to 500W.

SMALLER
FASTER
HIGHLY ACCURATE

This device is a miniaturized (less than 5 cm on a side), mirrored, force sensor that combines several key elements to make the sensor smaller, faster, and more sensitive to force

The design overcomes the limitations of allowing simultaneous power measurement during laser use.

The non-thermal approach of the Smart Mirror reduces measurement time, which allows for better sensing of rapid changes in laser power.



Photograph of a mounted pair of springs with high ref ectivity mirror designed for 1070 nm laser incident at 45 degrees.

BENEFITS

Highly accurate measurements that can be made in real time

Small, robust package for use on factory floor

Can be calibrated in-house using standard reference masses

Does not absorb laser light

CONTACT

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