

# A Cryogenic Calorimeter for Precise Measurement of Weak Laser Power

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(Received May 13, 1992; accepted July 4, 1992)

**Key words:** cryo-calorimeter, laser power, precise measurement, absolute radiometry

A cryogenic calorimeter operating near liquid helium temperature has been studied for weak laser power measurement. The principles of the measurement and fabrication of the measurement system are described. Experiments on  $0.1 \sim 1 \mu\text{W}$  measurement have shown scatters of  $\pm 2.5 \sim 0.1\%$ . The principal causes are considered to be the instability of the environmental jacket and the temperature control characteristics of the absorber.

## 1. Introduction

With the increasing use of weak laser power, such as in the field of optical communication, optical instruments have been attaining better performance. A laser power standard, which is important in such technology, has been developed by the Electrotechnical Laboratory, and a standard of  $10 \mu\text{W}$  power with  $\pm 0.2\%$  uncertainty has been established.<sup>(1,2)</sup> Today, even weaker laser power measurement is increasingly required, especially for fiber optics and sensing technologies, and sensitive measurement techniques are desirable.

Here, we have fabricated and tested a cryogenic calorimeter working near liquid helium temperature.