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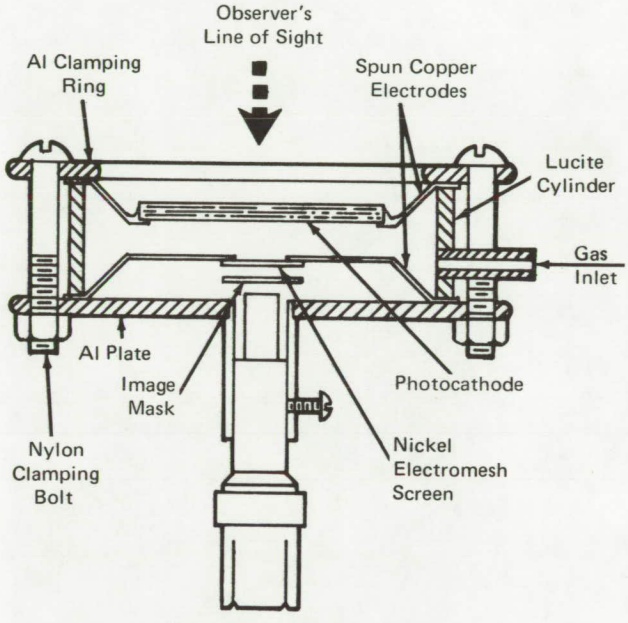
Lawrence Berkeley Laboratory

A Sensitive Image Intensifier Which Uses Inert Gas



The problem:

As a result of recent developments, many image intensifier configurations exist that have sufficient gain to photographically record an image of a single electron leaving a photocathode. Although sensitive, these devices require improved efficiency and resolution.

The solution:

An intensifier was developed which uses an inert gas in its cavity. The device provides an estimated optical gain of 2×10^7.

How it's done:

A cross section of the developed image intensifier is shown in the figure. The device uses two 5-cm spun copper electrodes which are spaced 1 cm apart to allow the electron avalanches to fully form without excessive pulse voltages. Toward the edges, the electrodes flare out to a 3-cm spacing to prevent electrical breakdown along the lucite cylinder walls. The aluminum plate and the clamping ring are held together with nylon insulating bolts.

A 4.5-cm (1.75 in) hole is cut in the upper electrode, and a 5-cm conducting glass disc is soldered in place to serve as a photocathode and an optical window. The glass is a Pyrex disc 3.2-mm thick which is coated with a thin transparent SnO_2 coating. Transmittance through this cathode is 85%. A 1.25-cm (0.5-in) hole is cut in the lower electrode to accommodate a nickel screen that prevents alteration of the electrical properties of the plate. This mesh has 25 holes/mm and is 80% transparent.

Experiments with this device used a pulse generating system which applied 30-kV/cm electric field pulses of 8-ns duration across a light amplifying chamber.

In addition helium, neon, and argon gases were tried to estimate their efficiencies.

Results of these tests showed that the developed intensifier produces up to 10^9 detectable photons from a single avalanche and, thus, provides an optical gain of 2×10^7. At this gain, the avalanche diameter of 0.5mm places an upper limit on resolution. At lower gains, the avalanche diameter is less than 0.1mm.

Note:

Requests for further information may be directed to:

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(continued overleaf)

Patent status:

Inquiries concerning rights for commercial use of this invention may be made to:

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