SO_2 SUBMILLIMETER LASER GENERATING AT WAVELENGTHS 0.141 AND 0.193 mm

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Submitted 26 March 1968
ZhETF Pis'ma 7, No. 11, 408 (5 June 1968)

We observed relatively strong laser emission at wavelengths 0.141 and 0.193 mm by discharge in a gas medium containing SO_2 and He. The laser operated continuously with a discharge current 0.15 A.

The laser glass tube, 2.5 m long and with inside diameter 56 cm, was cooled with running water to 14°C. The annular anode was made of molybdenum, and the hollow water-cooled cathode was made of aluminum. The resonator was made up of two mirrors of diameter 60 cm and radius of curvature 5 m. The radiation output aperture in one of the mirrors had an 8 mm diameter. The mirrors were made of glass sputtered with gold in vacuum. The seal window was made of saphhire 0.3 mm thick.

The laser operated with continuous gas-mixture supply. Using pure SO_2, the optimum power is reached at a pressure 2.1 mm Hg. Addition of helium (total pressure 3.6 mm Hg) stabilizes the discharge and increases the radiation power by one order of magnitude.

The discharge in the described gas mixture has a characteristic blue color. After prolonged operation, a deposit of sulfur is produced in some sections of the tube; it can be readily cleaned by discharge in air.

The wavelength was measured with a Fabry-Perot interferometer with reflectors made of wire grids, and the power was measured with a calorimeter. The radiation was determined with a pyroelectric receiver using a triglycine sulfate crystal. It is interesting to note that both waves were also registered with a crystal detector mounted in a waveguide of 0.5 x 0.2 mm cross section, with a silicon-tungsten thermocouple detector. The latter circumstance makes it possible to measure exactly the frequency by radiotechnical methods. The power was 1.5 and 0.3 mW at wavelengths 0.141 and 0.193 mm respectively.

The presently known strong lines in the submillimeter band are those of HCN molecules (λ = 0.336 mm and λ = 0.311 mm) and H_2O molecules (λ = 0.118 mm and λ = 0.079 mm).

The discovered SO_2 emission lines (λ = 0.141 mm and λ = 0.193 mm) can also be classified as strong, with a very favorable location in the band relative to the HCN and H_2O lines.

ENERGY SPECTRUM AND ANGULAR DISTRIBUTION OF THE PENETRATING COSMIC-RAY COMPONENT AT MOUNTAIN ALTITUDES

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Submitted 1 April 1968
ZhETF Pis'ma 7, No. 11, 409-412 (5 June 1968)

The characteristics of the penetrating component at the 20 m w.e. depth were investigated with the aid of a setup consisting of an ionization calorimeter and a hodoscope of gas-discharge counters. The array was located at an altitude of 3340 m above sea level at the Tyanshan' High-mountain Scientific Station of the Physics Institute of the USSR Academy of