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SESSION GB

New Yorker Grand Ballroom at 9:15

Masers I

GB1. Optical-Maser Action up to 57.355 μ in Neon. C. K. N. Patel, W. L. Faust, R. A. McFarlane, and C. G. B. Garrett, Bell Telephone Laboratories.—We have obtained optical maser oscillations at 57.355, 54.191, 53.486, 54.019, 54.116, and 53.755 μ in a discharge containing either pure neon or helium and neon. All of the maser wavelengths, between 31.928 and 41.714 μ, belong to the 6p-6d group of transitions (Racah notation) of neon.

GB2. Line Shapes of the 1.15-μ Ne Transition.* A. Szoke,† MIT.—Subsequent to an earlier work,† the power output of a He-Ne® optical maser oscillating at 1.15 μ has been measured as a function of its frequency, for various gas pressures between 6.5 and 1.5 mm Hg and two different He/H2 ratios, 10:1, 5:1. We find that pressure-broadening of the atomic spectral line is caused by collisions of excited Ne atoms with ground-state Ne and H2 atoms, each gas having approximately the same net effect at the operating pressures of the maser. Furthermore, we show that the pressure-introduced asymmetry in the atomic line shape to the extent of 1/100th of the linewidth. Accompanying this asymmetry is a shift to high frequency, which is estimated indirectly to be of the same order of magnitude. Lamb’s theory of the gas maser has been adapted to include asymmetric line shapes. The theory has been fitted to the experimental curves with the aid of a digital computer to obtain the above parameters characteristic of the line shape.

GB3. Microwave Oscillation Locked to O-0 Hyperfine Transition, Using a Rubidium 87 Maser Amplifier. M. Arditì, J. T. Holloway, and T. R. Carver, Princeton University.—Maser amplification in an optically pumped rubidium 87 gas cell has been previously described,1 but self-sustained oscillations have not been reported. With such a rubidium maser we report self-sustained microwave oscillations, at microwave frequency, using some additional gain introduced by a parametric amplifier to overcome insertion and coupling losses. The gas cell is enclosed in a microwave-transmission cavity connected to a low-noise parametric amplifier at 684 Mc/sec. The gain of the parametric amplifier is adjusted in such a manner that a gain greater than unity, from input of cavity to output of parametric amplifier, is obtained only when optical output is produced. The output of the parametric amplifier is connected, in proper phase, to the input of the transmission cavity, it is possible to obtain a microwave oscillation that is locked to the relatively stable (frequency of the O-0 hyperfine transition. A continuous microwave oscillation has been obtained when using a continuous-pumping Brillouin stabilized laser. A study of the oscillation buildup under various experimental conditions.

GB4. Hanle Effect of the 1470-A Xe Resonance Line. D. A. Nelson and W. L. W. Lincs, The University of Chicago.—The zero-field level crossing (Hanle Effect) was measured by a resonance-fluorescence technique with a natural mixture of Xe isotopes. At zero field, the population of the 6p-5d absorption transition is distributed among eight Zeeman sublevels. By exciting the 6p-5d absorption transition, the population of the ground state is increased. A Faraday-type Fabry-Perot interferometer was used in conjunction with the absorption cell located in a uniform magnetic field perpendicular to the plane containing the incoming and outgoing beams. Coherence-narrowing of the Lorentz line was observed. An extrapolation to zero pressure gave a full half-width of 40±4 G. Use of the optical value *g1=1.204 gave a lifetime of 3.6±0.1 μsec for the 5p 3/2 state of Xe, or an oscillator strength of 0.32±0.02. Use of the formulas giving oscillator strengths for the p class configuration2 gave the ratio of 1/8f1=0.9, or 0.61±0.033 for the total oscillator strength of the transition to the 5p4½ configuration from the ground state. The lifetime is from the effect of hyperfine structure of the odd isotopes.

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