Abstracts

Extension of The Laser-Pumped Ruby Maser to Millimeter Wavelengths

D.P. Devor. "Extension of The Laser-Pumped Ruby Maser to Millimeter Wavelengths." 1963 Transactions on Microwave Theory and Techniques 11.4 (Jul. 1963 [T-MTT]): 251-254.

A brief description is given on the operation of a microwave ruby maser in which the pump signal is the optical emission of a ruby laser. For operation in the millimeter spectrum the application of a magnetic field of inordinately high intensity can produce Zeeman splitting of the Cr/sup 3+/ levels at millimeter wave energy in the ground state in ruby. To obtain population inversion by optical pumping on the levels requires that the ratio of maser frequency to temperature be v/sub ij/ / T <14.4 Gc/sec °K. As the maser temperature is increased the spin lattice relaxation time T/sub 1/ decreases in addition to possibly decreasing with increasing magnetic field. Since the power required from the laser is estimated as that required to produce saturation of the optical pump transition in a time less thanT/sub 1/, then decreasing T/sub 1/ also requires increased laser emission. A broadening of the laser emission has been observed at increased power so that the limit on useful laser power can be given in terms of the absorption line width of the maser optical pumping transition. Treating these various effects conservatively indicates that the laser-pumped ruby maser can be operated over the entire millimeter spectrum, however. The design of an apparatus with a hard superconductor electromagnet producing the field intensity required to accomplish this objective is given.

❑ Return to main document.