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Coherent anti-Stokes Raman scattering microscopy in a microcavity MICHELE MARROCCO, ENEA — The combination of nonlinear spectroscopy and cavity QED is a stimulating field of research [see, for example, S. M. Spillane et al., Nature 415, 621 (2002)]. In this work, coherent anti-Stokes Raman scattering (CARS) taking place within a microcavity with parallel mirrors, is studied. The interest stems from the fact that CARS is a powerful nonlinear spectroscopic technique, particularly useful in imaging of microscopic samples [A. Zumbusch et al., Phys. Rev. Lett. 82, 4142 (1999)]. The theory of CARS microscopy applied to a sample placed within the microcavity is developed and the calculated CARS power in comparison with its free-space value shows the characteristic oscillation between inhibition and enhancement. If d and lambda indicate the cavity spacing and the anti-Stokes wavelength, inhibition is then found for d smaller than lambda and becomes complete only for microscope objectives operated in dry conditions. It is also found that the first enhancement at d=lambda is more relevant for microscopes with smaller numerical apertures. Higher numerical apertures, instead, reveal weaker cavity effects as a consequence of the larger collection efficiency.

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