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Using active gain medium to maximize light absorption[1] JIE WANG, WENZHE LIU, Fudan Univ, DEZHUAN HAN, Chongqing Univ, XIAOHAN LIU, LEI SHI, JIAN ZI, Fudan Univ, DEPARTMENT OF PHYSICS, FUDAN UNIVERSITY, SHANGHAI, CHINA COLLABORATION, DEPARTMENT OF APPLIED PHYSICS, CHONGQING UNIVERSITY, CHONGQING, CHINA COLLABORATION — Using an optical nanoresonator, such as a nano-particle, to concentrate and absorb light at the deep subwavelength scale is of both fundamental and practical significance. To quantify the ability of absorption, the absorption efficiency, i.e., the ratio of the absorption cross section of a local resonator to its geometric cross section, is always used. For a deep subwavelength particle, the absorption efficiency is only about 3. To increase the absorption efficiency of a deep subwavelength particle is challenging. In this work, a general method to control the absorption cross section of a deep subwavelength particle by using gain material is proposed and verified theoretically. The maximum absorption cross section, $3\lambda^2/8\pi n^2$, is demonstrated in the visible frequency region with a modest gain coefficient of the order of 10^4. Moreover, the method has been applied to boost the absorption and the local field enhancement of a single graphene ribbon in the mid-infrared region. It would be emphasized that, this method to increase the absorption of a deep subwavelength particle can be applied to other optical materials.

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