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Exploration of the electric and magnetic dipole transition mechanism for Nd³⁺ doped Yttrium aluminum borate

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When yttrium aluminum borate (YAB) crystal is doped with the rare earth ion called neodymium (Nd³⁺), it becomes a promising system for generating near-infrared lasers and self-frequency-doubling lasers because of its high nonlinear optical coefficient and huge stimulated emission cross section. To fully explore the likely transition mechanisms for this system, we carried out a systematic calculations of the transition intensities and radiative features within the 4f³ configuration of Nd³⁺ by using a complete free-ion Hamiltonian for the f-shell in conjunction with the crystal-field theory and the Judd-Ofelt theory. Based on the fitted values of free ion and crystal-field parameters reported by Cascales *et. al.*, the electric dipole (ED) induced transitions for excited states of Nd³⁺ ion in YAB were calculated. Our theoretical results indicated that the ${}^4F_{5/2} \rightarrow {}^4I_{9/2}$ transition is a good candidate for laser action at the near-infrared region. In addition, the magnetic dipole (MD) transitions were also shown with detailed values, providing a large number of strong absorption lines and spontaneous emissions for experimental use.

Biography

Yau-yuen Yeung is a Professor in Physics and Science Education in the EdUHK. He has around 200 academic publications in the form of book chapters, refereed journal papers, and conference presentations and has organised a number of international conferences.

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