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Spectroscopic Investigation of the R1m Line in Alexandrite at Low Temperature and Low Magnetic Fields

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Optical spectroscopic properties of the R1 line of Cr^{3+} in the mirror site of alexandrite ($BeAl_2O_4:Cr^{3+}$) were investigated by high resolution laser spectroscopy. The transitions between the $^4A2$ to ^2E levels were studied by polarised absorption measurement at 2.1K and the excited state splitting of ^2E level was found to be 36.6cm^{-1}. The fluorescent lifetime of Cr^{3+} ions occupying the mirror site was measured as 2.3ms. This is caused by the effect of photon trapping due to radiative energy transfer in the ^2E state, increasing the lifetime from 1.3ms at 2.1K. Transient spectral hole-burning was applied to examine the population dynamics between the atomic levels and the spectral holes were burnt at 679.75nm into the R1m line of at 2.1K by using a narrowband External Cavity Diode Laser. The hole decay time was obtained by probing the hole depths at at different delays. The hole-burning technique facilitates the observation of Zeeman splittings in very low magnetic fields. Magnetic fields from 0 to 11.8mT were applied to the alexandrite crystal along the three crystal axes and the side holes were observed in the hole-burning spectra. The applied magnetic field splits the two ground state Kramers doublets ($^4A2$ ±1/2, ±3/2) into four spin levels and the excited state ^2E (±1/2) split in to two spin levels, which is directly proportional to the strength of applied magnetic field. An analysis of the patterns allows an accurate determination of the g-factors in the excited state.

Biography:

Muhammed Ajmal Pallithadathil Nazer is a PhD student at the University of New south Wales Canberra since September 2015. His research is mainly focussed on the generation of slow and fast light by spectral hole-burning in transition metal and rare earth ion doped systems. He holds master degree in opto-electronics and laser technology from Cochin University in India and bachelors in Electronics and communication engineering from Kerala University, India. He has experience in nanotechnology and the development of high power solid-state laseras well. He was an Assistant Professor and presently hold the position of webmaster in IEEE ACT section, Australia. He has attended several conferences in which he published three conference papers and presented four posters in his career.