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Phonon assisted optical excitation in narrow bandgap spin-orbit insulator $Sr_3Ir_2O_7$ DEOK-YONG CHO, Institute for Basic Science, HYUN-JU PARK, CHANG HEE SOHN, DA WOON JEONG, Seoul National University, GANG CAO, University of Kentucky, KYUNG WAN KIM, Chungbuk National University, SOON JAE MOON, Hanyang University, TAE WON NOH, Seoul National University — We examined the temperature (T) evolution of the optical conductivity spectra of $Sr_3Ir_2O_7$ crystal. We found that the features of low energy d-d excitation ($\hbar\omega < 300$ meV) between two $J_{\text{eff}} = 1/2$ states, evolve drastically in a wide temperature range (4 K $<$ T $<$ 400 K). This large T evolution in the low energy feature is not observed in O K-edge x-ray absorption spectra, suggesting that it is presumably originated from phonon-assisted indirect optical transitions. The results of the simulation in which the phonon-absorbing and phonon-emitting processes is considered, show a consistency with the experimental spectra. The peak energy of the transition between two $J_{\text{eff}} = 1/2$ bands also decreases apparently by $\sim$100 meV along with the abundance of phonon-assisted charge excitations in the narrow bandgap semiconductor $Sr_3Ir_2O_7$.

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