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Multi-Gap Superconductivity in MgB_2: Magneto-Raman Spectroscopy A. MIALITSIN, B.S. DENNIS, G. BLUMBERG, Bell Labs, Lucent Technologies, N. D. ZHIGADLO, J. KARPINSKI, ETH, Zurich — We report polarization-resolved Raman scattering measurements on MgB_2 single crystals as a function of excitation, temperature and magnetic field with special attention paid to the superconductivity induced electronic collective modes and phonon renormalization. In addition to the two previously reported SC features: a fundamental gap below 32 and a SC coherence peak at 109 cm^{-1} - we observe a continuum onset shoulder at 48 and a collective mode at 78 cm^{-1} in the A_{1g} channel. Because MgB_2 optical conductivity exhibits inter-band excitation in the visible range resonant Raman coupling allows us to turn on and off SC features induced by different coupling mechanisms as we scan the Raman excitation energy. Since the absorption at 2.6 eV originates from distinctive inter-band transitions we are able to selectively determine inter-band coupling constant. Finally we demonstrate how the frequency and the line width of the Raman active E_{2g} phonon evolve with temperature and magnetic field. Tracking this evolution across the SC phase transition illustrates the self energy effect as the electronic spectra renormalize along with the blue-shift of the E_{2g} phonon.

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