PROBING THE EVOLUTION OF BONDING IN BERYLLIUM CLUSTERS; SPECTROSCOPIC IDENTIFICATION OF Be_4

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The beryllium tetramer has been observed for the first time utilizing pulsed laser ablation of Be metal followed by supersonic expansion into vacuum. The bonding characteristics are probed using electronic spectroscopy by detecting 1+1' REMPI generated ions and also by recording laser induced fluorescence spectra. A vibrational band progression in the UV region is observed and analyzed confirming the tetrahedral symmetry of the ground state. A time of flight mass-spectrometer is used to detect the ions confirming that the new signals have m/z = 36. Each vibrational band appears doubled which we attribute to Jahn-Teller distortion in the excited state. From the analysis of the rotationally resolved spectra we have determined that the Be-Be bond length in the ground electronic state contracts significantly compared with Be_2 illustrating a dramatic change in bonding characteristic. New ab initio calculations on Be_4 are also described in order to help interpret the experimental data. The ionization energy of Be_4 has also been measured using photo-ionization efficiency curves and compared with theory.