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Heat capacities of aluminum clusters ANNE STARACE, BAOPENG CAO, OSCAR JUDD, MARTIN JARROLD, Indiana University–Bloomington — Clusters of certain elements are known to undergo phase transitions from solid-like to liquid-like states. Aluminum clusters have emerged as a model system for metal cluster phase transitions [1]. We report here the measurement of heat capacities of cationic clusters containing 84 to 127 Al atoms using a multi-collision induced dissociation mass spectrometry method [2]. We find two major changes in the heat capacities with increasing cluster size: (1) the fluctuations in the temperature of the phase transition vary more smoothly and (2) the peaks in heat capacity become sharper. Furthermore, we have found a range of cluster sizes (115-117 atoms) that contain two distinct peaks, separated by baseline, in their heat capacities. The origin of the extra peaks in the heat capacity, which is suspected to be due either to a pre-melting transition or to a solid-to-solid transition prior to the melting transition, will be further investigated by means of annealing experiments. The current work extends prior work on singly charged Al cluster cations having 16-83 atoms [2, 3]. [1] Breaux, G. A.; Neal, C. M.; Cao, B.; Jarrold, M. F. Physical Review Letters 2005, 94. [2] Neal, C. M.; Starace, A. K.; Jarrold, M. F. Journal of the American Society for Mass Spectrometry 2007, 18, 74-81. [3] Neal, C. M.; Starace, A. K.; Jarrold, M. F. Physical Review B 2007, 76. [4] This work is supported by NSF.

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