

OPTICAL SPECTRUM OF THE ADAMANTANE RADICAL CATION

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Known for their stable structural and thermal properties, diamondoids and their radical cations are viable candidates as carriers for diffuse interstellar bands.¹ While previous diamondoid research has mainly focused on neutral molecules and their derivatives, little is known about their radical cations, which may form in interstellar environments by ionizing radiation.² We report the first experimental optical spectrum of the simplest diamondoid cation, the adamantane radical cation ($C_{10}H_{16}^+$), obtained via electronic photodissociation spectroscopy at 5 K between 310–1000 nm. The optical spectrum reveals a broad peak between 420–850 nm, assigned to the $D_2(^2E) \leftarrow D_0(^2A_1)$ transition. This feature exhibits no vibrational structure, despite an experimental temperature below 20 K, due to lifetime broadening and/or Franck-Condon congestion. A second band system originating at 345 nm does reveal a vibrational progression and is attributed to the overlapping $D_5(^2A_1)/D_6(^2E) \leftarrow D_0(^2A_1)$ transitions split by the Jahn-Teller effect. Comparison of the spectrum with known diffuse interstellar bands suggests that $C_{10}H_{16}^+$ is not likely to be a carrier. However, the strong absorption features in the UV to near IR show promise in the investigation of higher order diamondoid cations as potential candidates.³

[1] T. Henning and F. Salama 1998, *Science*, 282, 2204. [2] C. W. Bauschlicher Jr., Y. Liu, A. Ricca, A. L. Mattioda, L. J. Allamandola, 2007, *ApJ*, 671, 458. [3] P. B. Crandall, D. Müller, M. Förstel, J. Leroux, O. Dopfer, 2020, *ApJL*, 900, L20.