SYNCHROTRON-BASED HIGHEST RESOLUTION FOURIER TRANSFORM INFRARED SPECTROSCOPY OF NAPHTHALENE ($C_{10}H_8$): ROVIBRATIONAL ANALYSIS OF THE ν_{46} BAND

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One of the great challenges of astronomical infrared spectroscopy is the identification of the Unidentified Infrared Bands (UIBs) found in several interstellar objects. Polycyclic Aromatic Hydrocarbons (PAHs) have been proposed to be the carrier of the UIBs[a]. For that reason we have started to investigate the rotationally resolved FTIR spectrum of the bicyclic naphthalene[b] as a simple prototypical spectrum for a PAH infrared spectrum. These investigations at very high resolution, $\Delta\nu < 0.0008$ cm^{-1}, are only possible thanks to a new FTIR setup. We have interfaced an eleven chamber interferometer, the ETH-SLS Bruker prototype 2009, to the infrared port available at the Swiss synchrotron, the Swiss Light Source (SLS), located at the Paul-Scherrer-Institute. Due to the high brightness of the synchrotron radiation, which is effectively 5 to 10 times brighter than conventional thermal sources in the spectral region between 500 and 900 cm^{-1} (17-30 THz), and the high resolution of the new interferometer (unapodized resolution of 0.00053 cm^{-1}, 18 MHz), it was possible to analyze the newly rotationally resolved infrared spectrum of naphthalene ($C_{10}H_8$) previously recorded only at modest resolution in the IR[c] and at high resolution in the UV[d]. Here, we present a rovibrational analysis of the strongest band, consisting of c-type transitions of naphthalene in this region, the out-of-plane mode ν_{46}. We can simulate this band at different resolutions based on our analysis. Due to the unique band shape of a c-type band we propose a simple check for the UIBs to determine whether planar PAHs can be the carriers of these bands.

[a] A.G.G.M. Tielens, *Annu. Rev. Astron. Astrophys.* **2008**, *46*, 289.

[b] S. Albert, K.K. Albert, Ph. Lerch, M. Quack, in *Proceedings of the 17th Symposium on Atomic, Cluster and Surface Physics (SASP 2010)*, Obergurgl, Austria, 24th to 29th January 2010 (Eds. I. Milewski, A. Kendl, P. Scheier), Innsbruck University Press, Innsbruck, **2010**, ISBN 978-3-902719-52-2, pages 134-137.

[c] O. Pirali, M. Vervloet, G. Mulas, G. Malloci and C. Joblin, *Phys. Chem. Chem. Phys.* **2009**,*11*, 3443.

[d] M.H. Kabir, S. Kasahara, W. Demtroeder, Y. Tatamitani, A. Doi, H. Kato and M. Baba, *J. Chem. Phys.* **2003**, *119*, 3691.