

Molecular composition of comet 46P/Wirtanen

Nicolas Biver¹, D. Bockelée-Morvan¹, J. Crovisier¹, R. Moreno¹, G. Paubert², P. Colom¹, J. Boissier³, N. Dello Russo⁴, M. Cordiner^{5,6}, R. Vervack⁴, K. Hadraoui^{1,7}, S. Milam⁵, D.C. Lis^{8,9}

¹ LESIA, Observatoire de Paris, Université PSL, CNRS, Sorbonne Université, Université de Paris, Sorbonne Paris Cité, 5 place Jules Janssen, F-92195 Meudon, France (nicolas.biver@obspm.fr), ² IRAM, Avd. Divina Pastora 7, 18012 Granada, Spain, ³ IRAM, 300 rue de la piscine, 38406, St-Martin-d'Hères, France, ⁴ The Johns Hopkins University Applied Physics Laboratory, Laurel, MD 20723-6099, USA, ⁵ NASA Goddard Space Flight Center, 8800 Greenbelt road, MD 20771, USA, ⁶ Department of Physics, Catholic University of America, Washington DC 20064, USA, ⁷ LISA, Université Paris-Est Créteil, Université de Paris, CNRS, Créteil, France, ⁸ Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109, USA, ⁹ Sorbonne Université, Observatoire de Paris, Université PSL, CNRS, LERMA, F-75005 Paris, France

Abstract

Comet 46P/Wirtanen, the former Rosetta target, is a short-period Jupiter-family comet which made its closest approach to the Earth on 16 December 2018 at 0.077 AU. An international observing campaign [1] was established to follow this very favourable apparition. We observed comet 46P with the IRAM-30m and NOEMA radio telescopes between 11 and 25 December 2018 and with the Nançay radio telescope from September 2018 to February 2019. A dozen molecules (OH, HCN, HNC, CH₃CN, CH₃OH, H₂S, CS, H₂CO, NH₂CHO, CH₃CHO, CH₂OHCH₂OH, H₂CS, C₂H₅OH) were detected or tentatively detected and significant upper limits on the abundance of several others were obtained. This is the first Jupiter-family comet in which we could clearly detect complex organic molecules (such as formamide, acetaldehyde and ethylene-glycol). We will compare their abundances relative to water with those measured in other comets. While the composition of 46P appears relatively normal in methanol (~3.3% relative to water) and rich in H₂S (~0.9%), the comet shows strong depletion in HNC, HC₃N, CS, HCOOH and HNCO in comparison to other comets observed at similar heliocentric distances. The field of view of the observations was relatively small (500-1000 km) and these later molecules might have appeared under-abundant if coming from a distributed source in the coma of larger scale-length. The comet is also CO poor (CO/H₂O < 1.2%). Upper limits on the abundance of a dozen of other molecules and constraints on isotopic ratios will be presented.



Figure 1: Comet 46P/Wirtanen at closest approach on 16.1 Dec. 2018 and the Pleiades. © N. Biver

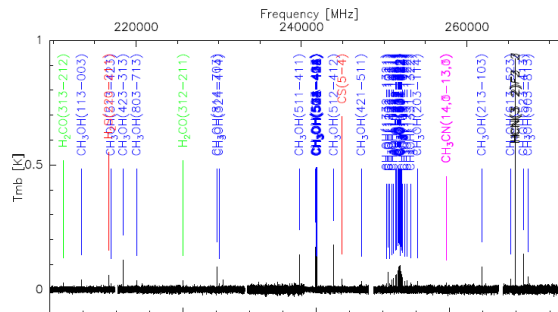


Figure 2: Comet 46P/Wirtanen combined spectrum at $\lambda \sim 1.2$ mm, with the main identified lines, obtained at IRAM-30m on 11-18 Dec. 2018.

References

[1] <http://wirtanen.astro.umd.edu/>