# GAS PHASE ROVIBRATIONAL SPECTROSCOPY OF DMSO, PART.I: WHEN A SYNCHROTRON SOURCE REVEALS AN UNUSUAL ROTATIONAL BEHAVIOUR

ARNAUD CUISSET, DMITRII A. SADOVSKII , *Laboratoire de Physico-Chimie de l'Atmosphère, 189A Ave. Maurice Schumann, 59140 Dunkerque, France*; OLIVIER PIRALI, *Ligne AILES, synchrotron SOLEIL, L'Orme des Merisiers, Saint Aubin, BP 48, 91192 Gif-sur-Yvette, France.*.

Many of us have enjoyed the spectacle of a spinning top influenced by friction: rotating rapidly about a stable stationary axis, the top loses slowly its angular momentum j (and energy), slows down gradually, and then, suddenly, its axis becomes unstable, the top wobbles, and an abrupt change of the tops position follows. In other words, the system undergoes a bifurcation. In the case of the tippe top, rotation about its lower point is stable at low values of angular momentum J and becomes unstable at large J. Something quite similar occurs in a freely rotating dimethylsulfoxyde (DMSO, $(CH_3)_2SO$) molecule. For the first time in such large polyatomic molecule a quantum bifurcation induced by a gyroscopic destabilization was observed. [a] This unusual phenomenon in rotational dynamics was discovered in the rovibrational states of the bending fundamental $\nu_{23}$ band of DMSO whose high-resolution gas phase absorption spectrum was observed along with that of $\nu_{11}$ by Cuisset et al. [b] using the exceptional properties of the AILES beamline in the Far-Infrared domain. [c]

[a] A. Cuisset, O. Pirali, D. Sadovskii,*Phys. Rev. Lett.*, **109**,(094101), 2012.
[b] A. Cuisset, L. Nanobashvili, I. Smirnova, R. Bocquet, F. Hindle, G. Mouret, O. Pirali, P. Roy, D. Sadovskii,*Chem. Phys. Lett.*, **492**,(30),2010
[c] J. B. Brubach et al., *AIP Conf. Proc.*, **1214**, (81), 2010.