SUPERFLUIDITY HIDDEN IN A FORGOTTEN CORNER

TAO ZENG, GREGOIRE GUILLON, and PIERRE-NICHOLAS ROY, *Department of Chemistry, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1*.

In 1998, Grebenev *et al.* [S. Grebenev, J. P. Toennies, and A. F. Vilesov, *Science*, **279**, 2083-2086 (1998)]] successfully conducted a spectroscopic Andronikashvili experiment to detect the superfluid response of a ^{4}He cluster with about only 60 atoms to the rotation of an embedded OCS chromophore. This success led to a new wave of investigations in the area of microscopic superfluidity. ^{4}He droplets and *para*-H_2 clusters exhibit this special phenomenon through their non-classical moments of inertia (NCMI) when they are dragged to rotate with a dopant. So far, all the studies are devoted to the diagonal elements of the moment of inertia tensor of the dopant and investigate how they are affected by the surrounding microscopic superfluids. In this way, the tensorial character of the moment of inertia has been ignored. We hereby report the first-ever study on the superfluid information conveyed by the off-diagonal elements of the moment of inertia tensor. We study the rotation of a methyl formate ($HCOOCH_3$) molecule doped in ^{4}He clusters. The C_s symmetry of $HCOOCH_3$ guarantees an off-diagonal moment of inertia tensor, and we found that the off-diagonal terms render superfluid information through the orientation of the principal-axes of the effective rotor with the surrounding ^{4}He atoms. This is a new piece of information extracted from the corners of the moment of inertia tensor. Technically, we have developed a symmetry-adapted path-integral Monte Carlo (SA-PIMC) program to simulate the $HCOOCH_3(^4He)_N$ clusters. This new algorithm leads to a better convergence of our simulations.