

## Dynamics in Confinement: a study of CH<sub>4</sub>@C<sub>60</sub>

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Endofullerenes are substances in which small molecules or atoms are encapsulated in highly symmetrical cages of carbon atoms. Each encapsulated atom or molecule behaves as a textbook example of a quantized particle-in-a-box. The newest and largest member of the endofullerene family tree, namely CH<sub>4</sub>@C<sub>60</sub>, is the first organic molecule trapped inside the cage and the main interest of this abstract. The use of various spectrometers at ILL, namely PANTHER, IN5 and IN1-LAGRANGE, have allowed us to probe a large energy window up from 1 to 100 meV. The goal from these experiments was to probe the rotational and translational states of the confined CH<sub>4</sub> molecule, and observe the coupling between said states due to the confinement. A novel result that we have observed in this endofullerene, was the effect of the  $I_h$  symmetry of the C<sub>60</sub> on the rotational states of the CH<sub>4</sub> using inelastic neutron scattering, an effect that was absent in previous endofullerene studies. We have also performed QENS measurements, using PANTHER, that have allowed us to observe slight differences in the rotational dynamics of both the C<sub>60</sub> and CH<sub>4</sub>, confirming the stronger guest-host coupling that we observed in our INS measurements.

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