**Structural properties and phase transitions of hydrogen and hydrogen-rich compounds**

**by quantum Monte Carlo**

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Quantum Monte Carlo offers a unique framework to compute accurate potential energy surfaces upon which nuclear dynamics takes place. Both electronic and nuclear degrees of freedom are fundamental ingredients to determine phase stability and structural properties, particularly in compounds bearing light elements such as hydrogen, strongly affected by nuclear quantum effects. In this talk, I will review some recent work aimed at combining quantum Monte Carlo with an anharmonic treatment of nuclear vibrations, and present some applications to hydrogen, hydrides and water clusters, where the quantum nature of both electrons and nuclei leads to original physics.