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Nota di contenuto	Motivation -- The helium-3 spin-echo experiment -- A new helium atom scattering apparatus -- An improved high intensity supersonic helium beam source -- The dynamics of cyclopentadienyl on Cu(111) -- Quantum influences in the diffusive motion of pyrrole on Cu(111) -- The diffusive motion of thiophene on Cu(111) -- Conclusions.
Sommario/riassunto	Chemical reactions and growth processes on surfaces depend on the

diffusion and re-orientation of the adsorbate molecules. A fundamental understanding of the forces guiding surface motion is thus of utmost importance for the advancement of many fields of science and technology. To date, our understanding of the principles underlying surface dynamics remains extremely limited, due to the difficulties involved in measuring these processes experimentally. The helium-3 spin-echo (HeSE) technique is uniquely capable of probing such surface dynamical phenomena. The present thesis extends the field of application of HeSE from atomic and small molecular systems to more complex systems. Improvements to the supersonic helium beam source, a key component of the spectrometer, as well as a detailed investigation of a range of five-membered aromatic adsorbate species are presented. The thesis provides a comprehensive description of many aspects of the HeSE method - instrumentation, measurement and data analysis - and as such offers a valuable introduction for newcomers to the field.