Public Abstract

First Name:Mark
Middle Name:Richard
Last Name:Patty
Adviser's First Name:Wouter
Adviser's Last Name:Montfrooij
Co-Adviser's First Name:
Co-Adviser's Last Name:

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Our understanding of the liquid (or molten) state of metals has progressed far within the past decades. Thanks to the advances in both x-ray and neutron scattering sources, it is now possible to measure the dynamics on a microscopic scale with very good statistical accuracy. The dynamics given by a single particle in a liquid metal owe to self-diffusion and cage diffusion. Presented are quasielastic neutron scattering studies of various liquid metals at low momentum transfers. The first part of this thesis is devoted to the investigation of a new (and unpredicted) contribution to the hydrodynamics of liquid metals. We present a literature review of published experiments to verify the presence of this new mode in liquid metals, followed by a possible explanation for its presence in terms of collision-induced magnetism. Next, we present a neutron scattering study at low momentum transfers using liquid gallium to verify the existence of this new contribution. The contribution turns out to be non-magnetic in origin, so another set of neutron scattering experiments is carried out, determining that the contribution should be attributed to multiple scattering processes in liquid gallium (though these same experiments suggest that this contribution is not a multiple scattering effect in liquid lead and mercury). In the last chapters of the thesis we investigate the potential effects of quantum mechanical diffraction effects on the collision between two ions. To carry out the investigation, we solved the collision between two almost classical particles using the partial wave method. We calculate the importance of this diffraction mechanism in liquid metals and present their influence on the neutron scattering cross-section when measuring the collision between two ions, given by an oscillation in the scattering cross-section.