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Thesis Title	*Diagrammatic Study of Green's and Response Functions of the Electron Gas*
Supervisor	E. Manousakis, Professor
Summary	Over a century has already lapsed since the emergence of Quantum Mechanics, though the specification of the exact wave function of many-body-systems still remains, in most of the cases, not accessible. As a result, it raises the question how it is feasible to approach -in theory- the experimentally measured quantities. This inherent difficulty may be overcome through the employment of Feynman's diagrammatic techniques and Green's functions. In the current essay, as a primary attempt to acquaint with the diagrammatic theory, the ground state energy of the homogeneous electron gas has been specified in the context of the Random Phase Approximation, which can be viewed as a first step to include a part of dynamical electronic correlations, totally absent in standard mean field theories; in this framework screening effects as long as elementary excitations of the system, known as quasi-particles, are highlighted. Furthermore, the diagrammatic perturbation theory, combined with the linear response theory, enables the calculation of response functions; based on the latter, it is attainable to calculate the screening potential and the dispersion relation of plasmons, which describe collective excitations.
Key words	Jellium Model, Elementary Excitations, Plasmons, Random Phase Approximation, Diagrammatic Perturbation Theory
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