Dobnikar J.: **Pseudo – Casimir forces in anisotropic polyelectrolytes**, PhD thesis, University of Ljubljana, Faculty for mathematics and physics, November 2000

Casimir effect is due to constrained fluctuations in media. The physical nature of the medium is not particularly important. Though the standard Casimir effect has been introduced for constrained electromagnetic field fluctuations, it has been realized that other systems with long-range correlations exhibit a similar type of fluctuation driven interactions. Most notably critical fluids, smectic manifolds and liquid crystals, all of them being prime examples of correlated fluids, give rise to a pseudo-Casimir effect which comes about through constrained thermal (as opposed to quantum) fluctuations of order parameters. The nature of these order parameters of course depends on the system under study but they all exhibit massless fluctuation spectra that eventually lead to long-ranged interactions.

In the first part the pseudo-Casimir force in a slab of material composed of nematically ordered long polymers has been investigated. The total mesoscopic energy together with the constraint connecting the local density and director fluctuations has been written and the corresponding fluctuation free energy has been evaluated by means of standard methods. The resulting pseudo-Casimir force is of a different type than in the case of standard, short molecule nematic. Its separation dependence and its magnitude have been investigated and the relevant limiting cases explicitly derived.

In the second part the pseudo-Casimir force acting between two charged surfaces confining a single polyelectrolyte chain with opposite charge has been studied. The exact free energy has been expanded up to the second order in the local electrostatic field as well as the polymer density field around the mean-field solution. The quadratic terms lead to a fluctuation interaction that is partly due to the Casimir effect for the confined electrostatic field and partly due to the pseudo-Casimir effect due to the confined polymer density field. The intersurface separation dependence of both effects has been obtained and it has been shown that the pseudo-Casimir effect leads to a long range attraction between the surfaces with an anomalous algebraic dependence.