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From the odd-even staggering to the pairing gap in neutron matter

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The properties of neutron matter are integral to the correct description of neutron stars and the extraction of their observables as well as the description of neutron-rich nuclei. One key property of neutron matter is its superfluid behaviour in a range of densities relevant to the inner crust of neutron stars. This talk will be centred around the finite size effects in the pairing gap of a pure neutron matter superfluid system at densities found in the inner crust of cold neutron stars. The BCS (Bardeen-Cooper-Schrieffer) treatment of superfluidity gives rise to the mean-field pairing gap, while a projection after variation leads to a beyond-mean-field pairing gap through an odd-even staggering formula. While these two pairing gap results should agree in the thermodynamic limit, we will show that this is the case for systems far from the thermodynamic limit as well. This aims in taking the first step towards a model-independent extraction of the pairing gap in neutron matter.

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