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A simple view on the quantum Hall system EMIL J. BERGHOLTZ, ANDERS KARLHEDE, Stockholm University — The physics of the quantum Hall system becomes very simple on a thin torus. Remarkably, however, the rich structure of the system still exists in this limit. On the very thin torus the many body problem reduces to a one-dimensional classical electrostatic problem and both the abelian and the non-abelian quantum Hall states are manifested as gapped one-dimensional crystals, Tao-Thouless states, with fractionally charged excitations that appear as domain walls between degenerate ground states. These states represent, but are extreme forms of, the observed states in the bulk and their qualitative properties (such as quasiparticle degeneracies, quantum numbers, relative size of the gaps etc.) remain the same. For the gapless states, there is a phase transition at finite thickness to phases different from the gapped crystals. At half-filling in the lowest Landau level, this new phase is a Luttinger liquid of neutral dipoles which is adiabatically connected to the gapless state observed in the bulk. The existence of the gapless phase on the thin (but finite) torus provides an explicit microscopic example of how weakly interacting quasiparticles moving in a reduced (zero) magnetic field emerge as the low energy sector of strongly interacting electrons in a strong magnetic field.

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