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AVHANDLINGENS TITTEL: *Binary Bose gases in synthetic magnetic fields*

Når atomer begrenses til å bevege seg i én eller to dimensjoner, vil de under visse forutsetninger oppføre seg på svært eksotiske måter. I dette arbeidet viser vi hvordan en blanding av gasser som består av to typer atomer oppfører seg i to dimensjoner når den utsettes for et «syntetisk» magnetfelt. Resultatene av forskningen gir ny forståelse av en teori som beskriver denne eksotiske oppførselen.

When atoms are forced to move in two dimensions under the influence of a strong synthetic magnetic field, analogues of many phenomena from solid-state physics are predicted to occur. In particular, quantum theory predicts a strongly correlated phase of matter similar to the quantum Hall liquid to form. This has led to an adaptation of the phenomenology of composite fermions (CFs), well known for its success in describing aspects of the fractional quantum Hall effect, to the realm of cold atoms.

In our first published work, we adapt this CF framework further, by extending it to our two-component system. We find that the CF approach gives extremely good descriptions of certain aspects of the system. Mathematically, the extended CF framework for atoms has some practical limitations. In the remaining published works, we identify several sources of these limitations, and propose a method to circumvent them, hence making the extended CF framework more powerful and easier to use.

Finally, we make the interesting generalization to a mixture of two gases that experience synthetic magnetic fields that point in opposite directions. Also in this case, we are able to mathematically describe the behavior very accurately.