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Role of inter-composite fermion interactions in fractional quantum Hall effect[1]

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One of the important challenges in the field of the fractional quantum Hall effect (FQHE) is to understand the nature of states that cannot be explained as integer quantum Hall effect of weakly interacting composite fermions; such states include FQHE at 5/2, 7/3, 8/3, 12/5, 13/5, 19/8 in the second Landau level (of GaAs) and 4/11, 5/13, 3/8(?) in the lowest Landau level. I will report on results [1,2] that demonstrate that multipartite wave functions of composite fermions provide an excellent account of the low energy physics of the model 3-body and 4-body interaction Hamiltonians that have the Pfaffian and the Read-Rezayi wave functions as their exact ground states. The relevance of these wave functions to the Coulomb solutions at 5/2 and 13/5 is investigated through an adiabatic scheme connecting the two models. In particular, the multipartite wave functions are shown to shed light on the structure of the neutral and charged excitations and of unpaired composite fermions [1]. We find that the residual interaction between composite fermions also has substantial effect at certain other fractions; it is predicted to produce a paired FQHE of the anti-Pfaffian kind at 3/8 [3], and unconventional trion excitations at 7/3 [4].

[1] G. J. Sreejith, C. Toke, A. Wojs and J.K. Jain, PRL 107, 136802 (2011).
[2] G. J. Sreejith, Y.-H. Wu, A. Wojs and J.K. Jain, unpublished.
[3] S. Mukherjee, S. S. Mandal, A. Wojs, J.K. Jain, unpublished.
[4] A. C. Balram, Y.-H. Wu, G. J. Sreejith, A. Wojs, J. K. Jain, unpublished.

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