

Abstract Submitted
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Composite-fermion trions in the fractional quantum Hall effect¹

AJIT COIMBATORE BALRAM, Pennsylvania State University, URSULA WURSTBAUER, Walter Schottky Institut and Physik-Department, Technische Universität, München, ARKADIUSZ WOJS, Institute of Physics, Wrocław University of Technology, ARON PINCZUK, Department of Applied Physics and Applied Mathematics and Department of Physics, Columbia University, JAINENDRA JAIN, Pennsylvania State University — Resonant inelastic light scattering experiments of the “fractional quantum Hall” state have indicated the existence of excitations below the Zeeman energy in the vicinity of the lowest Landau level filling $\nu = 1/3$. We investigate this observation in terms of composite fermions, the emergent particles of the fractional quantum Hall state that are bound states of electrons and two flux quanta. We identify the low energy excitations with positively or negatively charged composite-fermion(CF) trions, created when a photo-excited CF particle-hole pair forms a bound state with an existing CF particle ($\nu > 1/3$) or CF hole ($\nu < 1/3$). These are the smallest realizations of “skyrmions” in the fractional quantum Hall state. This identification is well supported by an excellent agreement between the calculated and the measured binding energies, and by the fact that the mode disappears for $\nu > 1/3$ when a transition to a fully spin-polarized state occurs. The spectroscopy of trion bound states serves as an extremely sensitive tool for investigating the interaction between composite fermions, which is relevant to the formation of exotic fractional quantum Hall states in this filling factor region, including those at $\nu = 4/11$ and $5/13$.

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Ajit Coimbatore Balram
Pennsylvania State University

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