Hydrodynamic description of spin Calogero-Sutherland model

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We study a non-linear collective field theory for an integrable spin-Calogero-Sutherland model. The hydrodynamic description of this $SU(2)$ model in terms of charge density, charge velocity and spin currents is used to study non-perturbative solutions (solitons) and examine their correspondence with known quantum numbers of elementary excitations [1]. A conventional linear bosonization or harmonic approximation is not sufficient to describe, for example, the physics of spin-charge (non)separation. Therefore, we need this new collective bosonic field description that captures the effects of the band curvature. In the strong coupling limit [2] this model reduces to integrable $SU(2)$ Haldane-Shastry model. We study a non-linear coupling of left and right spin currents which form a Kac-Moody algebra. Our quantum hydrodynamic description for the spin case is an extension for the one found in the spinless version in [3].

[1] Y. Kato,T. Yamamoto, and M. Arikawa, J. Phys. Soc. Jpn. 66, 1954-1961 (1997).
[2] A. Polychronakos, Phys Rev Lett. 70,2329-2331(1993).
[3] A.G.Abanov and P.B. Wiegmann, Phys Rev Lett 95, 076402(2005)

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