1 - 18 Density Dependence of Nuclear Symmetry Energy Constrained by Mean-field Calculations

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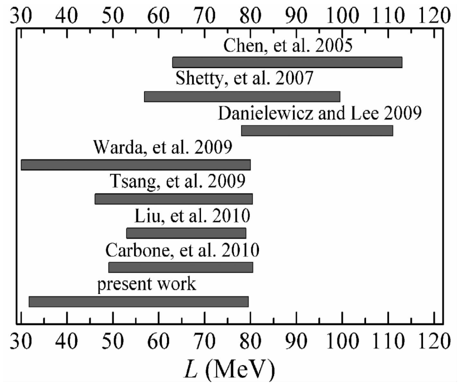

Fig. 1 Comparison between the L values obtained in the present work and those from other recently various analyses.

The symmetry energy that characterizes the isospin-dependent part of the equation of state (EOS) of asymmetric nuclear matter plays a crucial role in many issues of nuclear physics as well as astrophysics. We established a relation for three quantities S_0, L, and K_{sym} in widely different mean-field interactions[1]. With this relation and other constraint conditions, the density dependence of the nuclear symmetry energy $S(\rho)$ has been investigated in the present work and compare the results with those by other analyses[2-8], as shown in Fig. 1. With the obtained density dependence of the symmetry energy, the neutron skin thickness of ^{208}Pb and some properties of neutron stars were analyzed.

It is found that the expression $S(\rho) = S_0(\rho/\rho_0)\gamma$ or $S(\rho) = 12.5\,(\rho/\rho_0)^{2/3} + C_p(\rho/\rho_0)^{\gamma}$ does not reproduce the density dependence of the symmetry energy as predicted by the mean-field approach around nuclear saturation density. The L and K_{sym} values in the present study are (56±24) and (−125±79) MeV, respectively, and the neutron skin thickness of ^{208}Pb is (0.185±0.035) fm.

References

[1] Dong Jianmin, Zuo Wei, Gu Jianzhong, et al., Phys. Rev., C85(2012)034308.
[2] A. Carbone, G. Colo, A. Bracco, et al., Phys. Rev., C81(2010)041301(R).
[3] M. Liu, N. Wang, Z. X. Li, et al., Phys. Rev., C82(2010)064306.
[4] M. B. Tsang, Y. Zhang, P. Danielewicz, et al., Phys. Rev. Lett., 102(2009)122701.
[5] M. Warda, X. Vinas, X. Roca-Maza, et al., Centelles, Phys. Rev., C80(2009)024316.
[6] P. Danielewicz, J. Lee, Nucl. Phys., A818(2009)36.
[7] D. V. Shetty, S. J. Yennello, G. A. Souliotis, Phys. Rev., C75(2007)034602.
[8] L. W. Chen, C. M. Ko, B. A. Li, Phys. Rev. Lett., 94(2005)032701.

1 - 19 Exotic Hill Problem: Hall motions and symmetries

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The Hill problem arises as an approximation for nearly circular trajectories to Newton's gravitational equations written in rotating coordinates for bodies moving around a central mass. The original example is provided by the "Moon-Earth-Sun" system from[1]. Hill's equations have been also applied to stellar dynamics, with a "star cluster" replacing Moon and Earth, and the "Galactic Center" playing the role of the Sun.

Guided by the analogy with the noncommutative-Landau problem[2], we extended our previous study of Hill's equation to exotic particles. Our most interesting result states that for a critical angular-velocity i.e. for a critical radius determined by the noncommutative parameter θ, the only motions are those determined by the Hall law. The role of θ is to enhance the "Hall-type" behavior, eliminating all the others in the critical case $\Delta=0$.

Except for the lack of rotational symmetry due to the anisotropic oscillator-term, our results are reminiscent of those for the noncommutative-Landau problem, and generalize those for $\theta=0$. It is also worth

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mentioning that the dimensional drop in the critical case exemplifies the degeneration studied in in a general setting.

References

[1] G. W. Hill, Am. J. Math., 1(1878)5; M. C. Gutzwiller, Rev. Mod. Phys., 70(1998)589.
[2] P. M. Zhang, P. A. Horvathy, Ann. Phys., (N. Y.) 327(2012)1730.

1 - 20 Kohn Condition and Exotic Newton Hooke Symmetry in Non-Commutative Landau Problem

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Kohn's theorem says that a system of charged particles in a uniform magnetic field can be decomposed into center-of-mass and relative coordinates if the charge-to-mass ratios are the same for all particles. For an isolated system, the possibility of having a center-ofmass decomposition relies on the non-trivial cohomology of the Galilei group. In $d \geqslant 3$ space dimensions the latter is the same as the one which generates the central extension by the mass. In the plane the Galilei group also admits an "exotic" central extension, though, highlighted by the non-commutation of boosts. "Exotic" Galilean symmetry is realized by non-commutative particles in the plane; such a particle can be coupled to an electromagnetic field, leading to the non-commutative Landau problem.

In this work we combine and extend these results to a system of N exotic particles in the plane. First we briefly review some aspects of the Landau problem for N ordinary particles. Our new results show that, in both the regular and singular cases, the motion is fully determined by the respective conserved quantities.

The intuitive meaning of the Kohn condition is to guarantee a collective behavior: all particles rotate with the same frequency, shared also by their center-of-mass. The additional condition $e_a \theta_a =$ const implies that the typical factors $(1 - e_a \theta_a B)$ are the same for all particles, namely $(1 - e\Theta B)$, allowing us to extend Kohn's theorem to exotic particles.

Our new result is to prove the two-parameter centrallyextended "exotic" Newton-Hooke symmetry for our system of N exotic particles. As in the Galilean case, the commutation relations only differ from the ordinary (1-parameter) case in the boost-boost relation, which now also involves the non-commutative parameter Θ, and is supplemented by internal rotations and time translations.

It is worth saying that all our investigations have been purely classical. It is not difficult to quantize our system, though, as in the ordinary case[1].

Reference

[1] G. W. Gibbons, C. N. Pope, Ann. Phys., 326(2011)1760.