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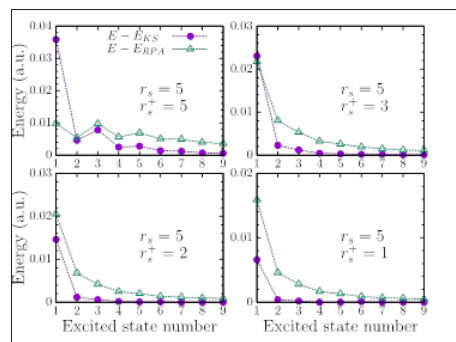
SMART AND EMERGING MATERIALS

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Crossover between collective and independent-particle excitations in quasi-2D electron gas with one filled miniband

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While it has been recently demonstrated that, for quasi-2D electron gas (Q2DEG) with one filled miniband, the dynamic exchange $f_x f_x$ and f_H kernels cancel each other in the low-density regime $r_s \rightarrow \infty$ (by half and completely, for the spin-neutral and fully spin-polarized cases, respectively) [1], here we analytically show that the same happens at arbitrary densities at short distances. This motivates us to study the confinement dependence of the excitations in Q2DEG. Our calculations unambiguously confirm that, at strong confinements, the time-dependent exact exchange excitation energies approach the single-particle Kohn-Sham ones for the spin-polarized case, while the same, but less pronounced, tendency is observed for spin-neutral Q2DEG [2]. (KS), and Random Phase Approximation (RPA) excitation energies of the fully spin-polarized quasi-2DEG of the density parameter $r_s=5$, confined with the strictly 2D uniform positive charge of the density parameter r_s^+ . For better visualization, each point is presented relative to the arithmetic mean of the TDEXX, KS, and RPA values.



References

1. V. U. Nazarov (2017) Quasi-low-dimensional electron gas with one populated band as a testing ground for time-dependent density-functional theory of mesoscopic systems, *Physical Review Letters* 118:236802.
2. V. U. Nazarov (2018) Crossover between collective and independent-particle excitations in quasi-2D electron gas with one filled miniband, arXiv:1802.07004 [cond-mat.mes-hall].

Recent Publications

1. V. U. Nazarov (2017) Quasi-low-dimensional electron gas with one populated band as a testing ground for time-dependent density-functional theory of mesoscopic systems, *Physical Review Letters* 118:236802.
2. V. U. Nazarov (2016) Exact exact exchange potential of two- and one-dimensional electron gases beyond the asymptotic limit, *Physical Review B* 93:195432.

Biography

Vladimir U. Nazarov, (Ph.D.-physics), is now an Associate Research Fellow at the Research Center for Applied Sciences, Academia Sinica, Taiwan. He got his B Sc in physics, M Sc physics from the Far-Eastern National University, Vladivostok, Russia, and his Ph.D. degree from the Institute for Automation and Control Processes, Far-Eastern Branch of Russian Academy of Sciences, Vladivostok, Russia. Currently Dr. Vladimir Nazarov's researches focus on the fundamentals of Time-Dependent Density-Functional Theory (TDDFT) and its applications to optics and transport in bulk materials and low-dimensional structures. Dr. Vladimir Nazarov has his Habilitation (in Russia, Doctor of Physical and Mathematical Sciences) from the Far-Eastern National University, Russia. The past positions of Dr. Vladimir Nazarov include the Leading Researcher at the Institute for Automation, Far-Eastern Branch of Russian Academy of Sciences, the Associate Professor at Kyushu Institute of Technology, Japan, Visiting Professor at the Institute for Solid State Physics, Japan, and Visiting Professor at Chonnam National University, South Korea

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