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047 – Multiple Exclusion Statistics

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A new distribution for systems of particles obeying statistical exclusion of correlated states is presented following the Haldane's state counting [F. D. M. Haldane, Phys. Rev. Lett. 67, 937 (1991)]. It relies upon a conjecture to deal with the multiple exclusion that takes place when the states available to single particles are spatially correlated and it can be simultaneously excluded by more than one particle. The Haldane's statistics and Wu's distribution [Y. S. Wu, Phys. Rev. Lett. 52, 2103 (1984)] are recovered in the limit of non-correlated states (constant statistical exclusion) of the multiple exclusion statistics. In addition, the exclusion spectrum function $G(n)$ is introduced to account for the dependence of the statistical exclusion on the occupation-number n. Results of thermodynamics and state occupation are shown for ideal lattice gases of linear particles of size k (k-mers) where multiple exclusion occurs. Remarkable agreement is found with simulations from k=2 to 10 where multiple exclusion dominates as k increases.

048 – Potentiation of *Allium sativum* Extract and Silver Nanoparticles used as an antifungal agent

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A natural and biocompatible extract of garlic as a support, decorated with silver nanoparticles, is a proposal to generate an effective antifungal agent against dermatophytes at low concentrations.
Many plants are bio-resource drugs of traditional medicine, modern medicine and food supplements due to their active substances (secondary metabolites) with therapeutic effects. [Ncube, N.S.'Assessment techniques of antimicrobial properties of natural compounds of plant origin: current methods and future trends', *Afr. J. Biotechnol.* 2008, 7, 1797–806.] Garlic (*Allium sativum*) is an example of these. Garlic is one of the most common plant used due to its antithrombotic, antioxidant, hypertensive, amebicide, parasiticide, antimicrobial, antifungal activity and cholesterol synthesis inhibitor in mammalian cells. [Ankri, S. 'Antimicrobial properties of allicin from garlic', *Micr Infect*. 1999, 1, 125–129., Sakamoto, L. D. 'Allyl sulfides from garlic suppress the In Vitro proliferation of human A549 lung tumor cells', *Nutr. Cancer* 1997, 29, 152–156., Alali, F.Q. 'Garlic for cardiovascular disease: prevention or treatment', *Curr. Pharm. Des.* 2017, 23, 1028–1041].
Silver is known for its inhibitory and bactericidal effects, and has been used to treat several infections and diseases [Shankar, S.S.'Rapid synthesis of Au, Ag, and bimetallic Au core-Ag shell nanoparticles using Neem (Azadirachta indica) leaf broth', *J. Colloid Interface Sci*. 2004, 275, 496–502]. Silver as an antimicrobial agent was almost forgotten when antibiotics such as penicillin were discovered, but due to antibiotic-resistant strains emergence, silver has reappeared as a promising alternative against bacteria, viruses and fungi. Silver nanoparticles (AgNPs) are currently used to control bacterial growth in a wide application, including dental materials, textiles, topical preparations and medical devices such as bandages to restrict bacterial growth in the sutured skin [Sharma, N. 'Antibacterial study of silver doped zinc oxide nanoparticles against *Staphylococcus aureus* and *Bacillus subtilis*', *Drug Invent. Today* 2013, 5, 50–54.]. Therefore, AgNPs can be used for treating fungal infection.
The aim of this work was to determine the antimycotic efficiency of botanical medicine, represented by garlic (AsExt), compared to successful and modern nanotechnology, represented by silver nanoparticles (AgNPs); and then to determine the antimycotic efficiency of garlic extract (AsExt), decorated with silver