2nd International Workshop SUPERHYDRIDES
Towards Room Temperature Superconductivity: Hydrides and More

Superconducting fluctuations in one-dimensional quasi-periodic "metallic" chains: The Little Model of room temperature superconductivity embodied

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It is well known that a purely periodic chain of odd-electron atoms, nominally expected to exhibit metallic behavior, is unstable to charge/spin spatial displacement which lowers its ground state energy by gapping its multi-degenerate Fermi surface, in this case consisting of nesting parallel sheets. It is largely for these reasons that superconductivity is not observed in highly one-dimensional metals -- it is simply energetically more favorable for CDW/SDW gaps to form, rather than a BCS state, at least one mediated by electron-phonon coupling. In this talk, we explore the hypothetical electronic properties of a nominally ``metallic" quasi-periodic chain using both an analytical approach and computationally with density functional theory, searching for configurations which yield ``gap-lets" sufficiently small to permit the formation of BCS pairs as the new energetically favored ground state. The particular embodiment we examine is a string of aluminum atoms with interatomic spacing determined by a Fibonacci sequence. We propose a path to attempt synthesis of such a structure for experimental examination, and perhaps leading to an entirely new class of higher temperature superconductors.