From: Allan Widom
Physics Department,
Northeastern University
Boston MA 02115
To whom it may concern:
Where things stand:

Ciao,

1+1 dimensional quantum field theories have in the past been applied to organic chemistry molecular chains. . In particular, the Thirring model is a Fermi-like point current-current ineraction was shown to be renormalizable as a Boson Sine Gordon Model by Sidney Colman.

1: Sydney Coleman, "Quantum Sine Gordan Eauation as te Massive Thirring Model", *Phys. Rev.* D11, 2088 (1975).

The electron dynamics is due to a screened short-range scattering length interaction of the Fermi-Type that is indeed renormalizable in one spatial dimension My version of Coleman is as follows. The current-current Lagrangian is given by

$$L_0 = -g\int dx\ (\overline{\psi}\gamma^{\mu}\psi)(\overline{\psi}\gamma_{\mu}\psi)\ , \tag{1}$$

and ***Yogi will love this***, the current interaction grows its own dynamics. For local charge conservation with charge per unit length $\lambda(x,t) = -\partial Q(x,t)/\partial x$ and current $I(x,t) = \partial Q(x,t)/\partial t$, conservation of charge is automatic and the current-current interaction becomes

$$L_0 = \frac{1}{2}\int dx\left[\frac{\mu I^1}{c^2} - \frac{\lambda^2}{\varepsilon}\ \right]\ = \frac{1}{2}\int dx\left[\frac{\mu}{c^2}\left(\frac{\partial Q}{\partial t}\right)^2 - \frac{1}{\varepsilon}\left(\frac{\partial Q}{\partial x}\right)^2\ \right]\ , \tag{2}$$

wherein μ is the inductance per unit length and ε is the capacitance the unit length. The velocity of longitudinal mass-less photons is $v = c/\sqrt{\mu\varepsilon}$. The electron mass term then adds the long wavelength Lagrangian

$$L_1 = mc^2\int dx(\overline{\psi}\psi) = \hbar\nu\int dx\cos\left(2\pi\frac{Q}{e}\right). \tag{3}$$

The total Sine-Gordon Boson Lagrangian is the result

$$L\ = \frac{1}{2}\int dx\left[\frac{\mu}{c^2}\left(\frac{\partial Q}{\partial t}\right)^2 - \frac{1}{\varepsilon}\left(\frac{\partial Q}{\partial x}\right)^2\ \right] - \hbar\nu\int dx\left[1-\cos\left(2\pi\frac{Q}{e}\right)\right]\ . \tag{4}$$

This leaves two other soliton modes to describe DNA. Here it is of importance to include the Japanese with missed by their purely mechanical approach why bacteria sing.

2: Liya Liu1 and Chuanzhong Li, "Coupled Sine-Gordon Systems in DNA Dynamics", Adv. in Math. Phys., 4676281 (2018).
Volume 2018, Article ID 4676281,
https://doi.org/10.1155/2018/4676281

3: Daniel and V. Vasumathi, "Solitonlike base pair opening in a helicoidal DNA: an analogy with a helimagnet and a cholesteric liquid crystal," Physical Review E: Statistical, Nonlinear, and Soft
Matter Physics, vol. 79, no. 1, 2009.

We note in passing that that the first 1+1 dimensional field theory applied to organic molecular chains a Thirring-Sine Gordon model was for acetalyne chains $(CH)_N$ with chemical bonding

=C-C=C-C=C-C= C-C= C-C= C-C= C-C= C-C= C-C= C-C= C-C= C-C= C-C= C-C=

with **an implicit single hydrogen H bonded to each carbon in the chain**. A Sine-Gordon kink is a single electron shown below in red

=C-C=C-C=C-C= C-C= C-C= C-**C=C= C**-C= C-C= C-C= C-C= C-C= C-C= C-C=

that carries a single electronic charge and not half a charge Shcrieffer and Jackiw may have thought. These were days when 1/3 a charge for the quantum Hall effect was taken seriously.

Ciao for now.

Allan