D-brane backgrounds should play a role in the description of the QCD vacuum analogous to the treatment of the CP^{N-1} model that we consider in this paper. In both cases, we are dealing with the laminar collapse of a spacetime filling D-brane which occurs locally along a single coordinate direction, with the BCFT for that coordinate acquiring a tachyonic boundary perturbation.

III. BLOCH WAVES AND BAND STRUCTURE FOR A PROPAGATING STRING: THE CONNECTION BETWEEN $R = R_0$ AND $R = \infty$

For the oscillatory boundary perturbation

$$\lambda(X) = g\cos(X/\sqrt{2\alpha'}) \tag{16}$$

the spectrum and partition function for the bosonic string have been analyzed both for the case $R = R_0$ and $R = \infty$ in Refs. [11, 13]. Here we are interested in the bulk properties of the zero temperature CP^{N-1} model, so the case $R = \infty$ is most directly relevant to our discussion. However, it is instructive to first review the properties of the string spectrum with coordinate compactified at the $SU(2)$ radius R_0. The spectrum at $R = \infty$ can then be understood in terms of Bloch wave states. The $R = \infty$ theory exhibits a "stringy" band structure, with each band corresponding to one of the eigenstates of the compactified $R = R_0$ theory [11, 13]. For the $R = \infty$ theory with boundary perturbation (16), the Bloch wave basis allows a separation between translational and internal motion analogous to the free string case. Note that the spacing between branes is set by the periodicity of the boundary perturbation (16), $2\pi R_0$. This period is also the circumference of the compactified coordinate at the $SU(2)$ radius, so the theory at the $SU(2)$ compactification point describes a unit cell of the tachyonic crystal in the $R = \infty$ theory.

For nonzero g, the eigenvalue spectrum of the $R = \infty$ theory consists of bands separated by gaps. Just as in the case of an ordinary particle in a periodic crystal, there are two complementary viewpoints to describe the spectrum of bands and band gaps, the tight binding approximation (TBA) and the nearly-free string (NFS) approximation. In the TBA, the Bloch wave states of the $R = \infty$ theory are constructed from plane wave superpositions of eigenstates defined on a unit cell. Each eigenstate on the unit cell gives rise to a band of eigenvalues for the $R = \infty$ theory. The critical boundary perturbation $g = \frac{1}{2}$ corresponds to the tight binding limit, in which the states in a band become degenerate, and the spectrum for $R = \infty$ is just a replication, on each cell, of the discrete spectrum at the SU(2) radius. This is the case when the end of the string is firmly stuck to a single D-brane of the tachyonic crystal and does not hop to neighboring cells, so