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0-BRANE MATRIX DYNAMICS FOR QCD PURPOSES: REGGE TRAJECTORIES

AMIR H. FATOLLAHI

Department of Physics, Alzahra University, Vanak 1993893973, Tehran, Iran

Abstract. The energy spectrum of two 0-branes for fixed angular momentum in 2+1 dimensions is calculated by the Rayleigh-Ritz method. The basis function used for each angular momentum consists of 80 eigenstates of the harmonic oscillator problem on the corresponding space. It is seen that the spectrum exhibits a definite linear Regge trajectory behavior. It is argued how this behavior supports the picture by which the bound-states of quarks and QCD-strings are governed by the quantum mechanics of matrix coordinates.

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1. Introduction

The string theoretic description of gauge theories is an old idea [20, 23, 24], still stimulating research works in theoretical physics [14, 17, 21]. Depending on the amount of momentum transfer, the hadron-hadron scattering processes have shown two different behaviors [2, Ch.14], [22]. At very large momentum transfers the interactions are among the point-like substructures, and qualitative similarities to electron-hadron scattering emerge. At high energies and small momentum transfers the Regge trajectories are exchanged. The exchanged linear trajectories are the first motivation for the string picture of strong interaction. However, the fairly good fitting between the linear Regge trajectories and the mass of QCD bound-states has not been explained yet [17], partially due to the lack of a consistent formulation of string theory in 3+1 dimensions

According to string theory, 0-branes are point-like objects to which the strings can end [18, 19]. It is known that in a specific regime the dynamics of N 0-branes is governed by the matrix quantum mechanics resulting from dimensional reduction