# TWO-DIMENSIONAL NONCOMMUTATIVE FIELD THEORY ON THE LIGHT CONE

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**Abstract.** The two-dimensional noncommutative field theory on the light cone is studied from the usual Moyal product formalism. The Noether currents and the components of the energy-momentum tensor are explicitly computed.

## 1. Introduction

One of the major outstanding problems in Physics is the calculation of observable processes in strongly interacting field theories like QCD and electroweak theory. In particular, it is difficult to calculate, from first principles, the hadronic spectrum, structure functions, fragmentation functions, weak decay amplitudes and nuclear structure. The two most promising attempts to tackle strongly interacting field theories are lattice calculations and light cone field theory. In the 60's, Fubini and Furlan [6] showed that, in a Poincaré invariant theory, calculations may be simpler in an "infinite momentum frame", i.e., in a frame moving with a velocity $v \to c$ (the light velocity) relative to the centre of mass. Weinberg showed that the singularities for $\gamma = \frac{1}{\sqrt{1-(\frac{v}{c})^2}} \to \infty$ cancel in the physical observables [15]. The net effect (apart from a singular scale factor) is to transform to the light cone coordinates

$$x^+ := \frac{1}{\sqrt{2}}\left(x^0 + x^3\right), \quad x^- := \frac{1}{\sqrt{2}}\left(x^0 - x^3\right), \quad x_\perp = \left(x^1, x^2\right) \text{ unaffected}$$

with $x^+$ regarded as the (light cone) time and $x^-$, $x^1$ and $x^2$ regarded as spatial coordinates. This interpretation is crucial as the Hamiltonian formalism does not treat space and time in a symmetric way.

Recently, the investigation of the gauge field theories in a noncommutative space-time has become of increasing interest [1–6], [8–10], [12–15].