where C_i is a complete set of independant closed cycles of the torus, and ℓ_i topological numbers characteristic of the torus (see ref. 2).

In general, exact knowledge of the invariant tori is equivalent to a solution by quadratives of the classical system. However, there exists non trivial field theories where the invariant tori are known. These are presently under study. More important, the invariant tori around a known stable classical orbit can be constructed by an iterative convergent process. The validity of the lowest order of the iteration is that of perturbation theory, and it can be derived from the functional integral which defines the field theory (a simple example of this approximation in potential theory is described in ref. 5).

By applying these ideas to the two-dimensional field theory described by the Lagrangian

$$L = \tfrac{1}{2}\,(\dot{\phi}^2 - \phi'^2) + m^2\phi^2 - \lambda\phi^4,$$

we have been able to find the existence of n-particle bound states in the weak coupling limit.

REFERENCES

1) R Dashen, B Hasslacher and A Neveu: Extended Hadrons in field theory, Institute for Advanced Study preprints.

2) V Maslov. Asymptotic methods for partial differential equations (book in Russian).

3) A Voros: Semiclassical approximations, Saclay preprint.

4) V Arnold and A Avez. Ergodic problems in classical mechanics.

5) M Gutzwiller. J. of Math. Phys. 12 343 (1971).

TRANSLATION INVARIANT QUANTUM FIELD THEORY WITH DE-SITTER MOMENTUM SPACE OFF THE MASS SHELL

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A specific point for the standard extension of the S-matrix off the mass shell (1,2) is the assumption that four dimensional momentum space is flat. Such a choice of geometry is one independent postulate of the theory. Flat momentum space may not be adequate for high energies and is actually responsible for the ultra violet divergencies of local quantum field theory.

As an alternative we propose (3) to use a 4-momentum space of constant curvature (De-Sitter space):

$$p_o^2 - \vec{p}^2 - \frac{p_4^2}{\ell^2} = \frac{1}{\ell^2}\,, \qquad (1)$$

where ℓ is a new universal "fundamental length". The interaction laws of the elementary particles at large momenta become completely different.

We demonstrate that the off-mass-shell extension of the S-matrix in De-Sitter p-space is consistent

with the requirements of Lorentz and translation invariance ($\phi(p,p_4) \to e^{ipa}\phi(p,p_4), pa=p_a a_o - \vec{p}.\vec{a}$), unitarity, spectrality, etc.

By Fourier transformation in De-Sitter p-space a new configuration quantized ζ-space is introduced. Its geometry for small distances ($\lesssim \ell$) is essentially different from the pseudoeuclidean one. It is remarkable that in the same time the new ζ-space exhibits "causal" structure in the sense that it is divided into two regions: timelike region with invariant time ordering and spacelike region. We formulate in terms of this ζ-space the direct natural generalization of Bogolubov's causality condition. The problem of distribution products and ultraviolet divergencies loses its acuteness. The commutation functions and propagators become usual functions. For instance the D-function in the case m=0 takes the form:

$$D(\zeta)\Big|_{m=0} = \frac{1}{2\pi}\,\varepsilon(n)\,\frac{1}{L+2}\,\delta_{L,-1}, \qquad (2)$$

$n=0,\pm1,\pm2,\ \ldots,\quad L=-1,0,1,\ \ldots$

instead of $D(\zeta)\Big|_{m=0} = \frac{1}{2\pi}\,\varepsilon(\zeta_o)\delta(\zeta^2)$

REFERENCES

1) N N Bogolubov, A A Zogunov, I T Todorov, Axiomatic Approach to Quantum Field Theory, Moscow 1969.

2) B V Medvedev, V P Pavlov, M K Polivanov, A S Dukhanov, Theor. and Math. Phys. 13,3,1972.

3) A D Donkov, V G Kadyshevsky, M D Mateev, R M Mir-Kasimov, Dubna Preprints, E2-6992, 7936, 1974.

CONSTRUCTION OF INTERACTING AND ASYMPTOTIC FIELDS IN $\lambda\phi_4^4$ THEORY.

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The canonical formalism for non linear relativistic classical field theory is presented. It is shown that the solutions $\phi(x)$ of the non linear equation $(\Box + m^2)\phi(x) = \lambda\phi^3(x)$ as well as the asymptotic fields $\phi_{in}(x)$ and $\phi_{out}(x)$ are local relativistic fields with respect to Poisson brackets, with initial data as canonical variables. A convenient form for the generators of the Poincaré group is derived and the properties of the scattering operator are discussed.