

Zeitschrift: Helvetica Physica Acta
Band: 59 (1986)
Heft: 5

Artikel: Exact solution of the non-linear -models
Autor: Wiegmann, P.
DOI: <https://doi.org/10.5169/seals-115774>

Nutzungsbedingungen

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften auf E-Periodica. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. Das Veröffentlichen von Bildern in Print- und Online-Publikationen sowie auf Social Media-Kanälen oder Webseiten ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. [Mehr erfahren](#)

Conditions d'utilisation

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. La reproduction d'images dans des publications imprimées ou en ligne ainsi que sur des canaux de médias sociaux ou des sites web n'est autorisée qu'avec l'accord préalable des détenteurs des droits. [En savoir plus](#)

Terms of use

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. Publishing images in print and online publications, as well as on social media channels or websites, is only permitted with the prior consent of the rights holders. [Find out more](#)

Download PDF: 09.08.2025

ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>

EXACT SOLUTION OF THE NON-LINEAR σ -MODELS

P. Wiegmann

Landau Institute for Theoretical Physics

Moscow

A brief review of the recent developments in the theory of non-abelian Goldstone bosons in two dimensions, as worked out by Polyakov and myself^{1,2} is presented. Exact solutions of the non-linear σ -models were found. These are the simplest examples of field theories where geometrical constraints due to the non-abelianess of the manifold create strong interactions, leaving the theory asymptotically free at small distances. The several infrared singularities induced by increasing interactions at large distance scale impede studies of the low-energy regime by perturbative methods. However, the dynamics of the problem is governed by the infinite set of the non-trivial quantum conservation laws. It means that the theory is completely integrable and can be solved exactly by the Bethe-Ansatz technique. We have proposed such a solution for all three canonical σ -models and on this basis described completely the particle spectrum, scattering amplitudes and thermodynamic properties. We have considered

- a) the principal chiral σ -model (or $G \otimes G$ σ -model)
associated with a simple Lie group G ;
- b) the chiral model with multivalued Wess-Zumino action ;
- c) the $O(3)$ σ -model describing the Goldstone field on the
two-dimensional sphere S^2 .

The first and the third models exhibit a massive spectrum due to the dimensional transmutation phenomenon, and the fixed points of them are in the strong coupling limit. However, the second model remains massless and has a finite fixed point. The reason of such a behaviour is the violation of the discrete symmetries by the Wess-Zumino term.

- 1) Polyakov A.M., Wiegmann P.B.; Phys. Lett 131B, 121 (1983)
ibid 141B, 223 (1984)
- 2) Wiegmann P.B. Physics Letters 141B, 217 (1984)
ibid 142B, 173 (1984)
ibid 152B, 209 (1985)
Nuclear Phys. B to be published.