GAST

(Gauge and String Theories)

Sezione di Pisa

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PERSONALE

Stefano Bolognesi (UniPi Professore Associato, Incarico di ricerca INFN)

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-Sigma models, Large-N, Topological solitons.

The two-dimensional CP(N) sigma model is interesting as an analogous model for nonperturbative dynamics of QCD, possessing asymptotic freedom and confinement; it can also be related to some phenomena in condensed matter physics. We recently examined analytically the large-N gap equation and its solution for spaces, in particular compact ones, with and without boundaries. We plan to continue these investigations and hopefully extend these insights to different types of spaces and boundary conditions, different sigma models and higher dimensions.

-Gauge theories (non-perturbative aspects), (Generalized) Symmetries and Anomalies, Dynamics of chiral gauge theories.

In spite of the bulk of knowledge accumulated after almost half-century of studies of vectorlike gauge theories such as SU(3) quantum chromodynamics (QCD), surprisingly little is known today about strongly coupled ordinary (nonsupersymmetric) chiral gauge theories. Many questions can be asked in these types of theories. Answers, or at least constraints on possible answers, can be obtained with the use of standard or new techniques such as 't Hooft anomaly matching conditions.
Recently the concept of generalized symmetries has been applied to Yang-Mills theories and QCD like theories, to yield new, stronger, version of 't Hooft anomaly matching constraints. Mixed 't Hooft anomalies between 1-form symmetries and some 0-form (standard) discrete symmetries provide useful information about the infrared dynamics of the system. In some cases, they give decisive indication to select only few possibilities for the infrared phase of the theory.

-Gauge-Gravity duality and applications, Topological solitons.

Using the Witten-Sakai-Sugimoto (WSS) model, the top-down holographic theory closest to QCD, some open strong-coupling problems can be addressed using analytic techniques. Nuclear physics aspects have not been developed in sufficient detail. Our main tool is the well-known relation between WSS model and Skyrme model. We plan to continue in these directions, expanding all possible links between the holographic QCD and Skyrme model.