The Abdus Salam
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Advanced Workshop on
"Anderson Localization, Nonlinearity and
Turbulence: A Cross-Fertilization"

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TITLE:
``High-gradient Operators and Anderson Localization"

ABSTRACT:

Many classes of non-linear sigma models (NLSMs) are known to contain composite operators with an arbitrary number 2s of derivatives ("high-gradient operators") which appear to become strongly relevant within RG calculations at one (or fixed higher) loop order, when the number 2s of derivatives becomes large. This occurs at many conventional fixed points of NLSMs which are perturbatively accessible within the usual epsilon-expansion in d=2+\epsilon dimensions. Since such operators are not prohibited from occurring in the action, they appear to threaten the very existence of such fixed points. At the same time, for NLSMs describing metal-insulator transitions of Anderson localization in electronic conductors, the strong RG-relevance of these operators has been previously related to statistical properties of the conductance of samples of large finite size ("conductance fluctuations"). We will discuss recent developments on the role played by "high-gradient operators" in two-dimensional quantum field theories, some of which are related to metal-insulator transitions of Anderson localization.