



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

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TITLE:

"Integrable and Chaotic Phenomena in the FPU Problem: From Stable Periodic Orbits to Diffusion in Phase Space"

ABSTRACT:

New results on the classical Fermi-Pasta-Ulam problem (or "paradox") are reported. In particular, the so-called alpha model is considered, with initial excitation of the fundamental mode. It is shown that at low energy, the modal energy spectrum of the system superposes almost perfectly to that of the integrable Toda model on a first, energy-dependent time-scale. An analytic description of such a modal energy spectrum can be given, if the energy is low enough, in terms of q-breathers.

On a second and longer time-scale the modal energy spectrum of the alpha model starts to move and finally reaches an equipartition state. In particular, it is shown that a simple law of (anomalous) diffusion characterizes the motion of tail modes, which also allows to get a simple (under-)estimate of the equipartition time even when the latter cannot be practically measured.