Numerical Analysis of the Renormalization Group Differential Equations in Various Physical Problems

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We have investigated focus points of the renormalization group equations of the Minimal Supersymmetric Standard Model and Next to Minimal Supersymmetric Standard Model. We show that within this model the up- and down-type Higgs mass soft supersymmetry breaking parameters have focus point behavior at the electroweak scale simultaneously when appropriate conditions are fulfilled. The focus point scenario is holding for large $\tan\beta$. This two focus point scenario allows one to fix the pole top-quark mass which is within the experimentally allowed interval. The main goal is the investigation of the influence of the existence of focus points on the determination of the mass of the lightest Higgs boson [1].

The advection of a passive scalar quantity by incompressible helical turbulent flow has been investigated in the frame of an extended Kraichnan model. Statistical fluctuations of the velocity field are assumed to have the Gaussian distribution with zero mean and defined noise with finite time-correlation. Actual calculations have been done up to two-loop approximation in the frame of the field-theoretic renormalization group approach. It turned out that the space parity violation (helicity) of a stochastic environment does not affect anomalous scaling which is the peculiar attribute of corresponding model without helicity. However, stability of asymptotic regimes, where anomalous scaling takes place, and the effective diffusivity (Fig. 1) strongly depend on the amount of helicity [2, 3].

Influence of helicity and compressibility on the scaling regimes has been investigated in the frame of the model of passive scalar advected by turbulent flow with finite time correlations of velocity field [4, 5].

References

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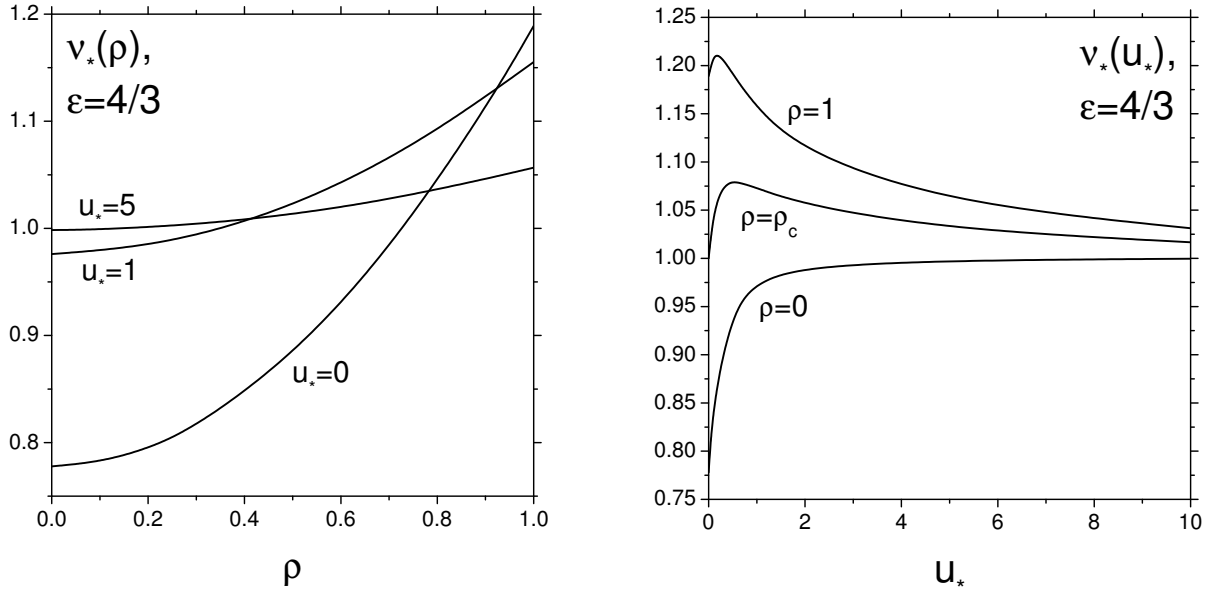

Figure 1: (Left) The dependence of ν_* (fixed point value for diffusivity) on the helicity parameter ρ for definite IR fixed point values u_* of the parameter u (parameter related to finite time correlations of velocity field). (Right) The dependence of ν_* on the IR fixed point u_* for the concrete values of the helicity parameter ρ

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