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Coherent backscattering of inelastic photons from atoms and their mirror images

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Coherent backscattering is a coherence effect in the propagation of waves through disordered media involving two or more scattering events. Here, we report on the observation of coherent backscattering from individual atoms and their mirror images. This system displays two important advantages: First, the effect can be observed at low optical densities, which allows to work in very dilute clouds or far from resonance. Second, due to the fact that the radiation of an atom interferes constructively with that of its own image, the phenomenon is much more robust to dephasing induced by strong saturation. In particular, the contribution of inelastically scattered photons to the interference process is demonstrated.

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The atomic nucleus as a nonlinear relativistic Fermi-system

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The nonlinear relativistic theory is an elegant and powerful method to describe the properties of atomic nuclei treated as a relativistic essentially nonlinear Fermi-system with strongly pronounced iso-vector structures. The development of the relativistic description is loosely connected with the success of the meson theory, in particular of the meson theory of the NN-interaction. Nowadays nuclear physics at low energies is presented in a completely relativistic form and the respective theory reproduces wide range of physical phenomena. Within this theory the atomic nucleus is considered as a system of nucleons moving under the influence of the meson fields of different nature, i.e. of the meson fields with different space-time transformation properties. In this case into consideration are included the scalar S, the vector V, etc. meson fields (one should have in mind the properties of these fields under the Lorentz transformations). It is just because of these reasons the adequate theory of the atomic nucleus should be relativistic. The very important feature of the relativistic nuclear shell model is the existence in the nucleus of two strong meson fields: the attractive scalar field S(r) (with the depth about -420 Mev) and the repulsive vector field V(r) (with the value about +330 Mev).The existence of these fields in the nucleus can be considered at present as a firmly established fact, determining, in particular, the proper sign and value of the nuclear spin-orbit potential. The strong scalar field also determines in the nucleus the small value of the nucleon effective mass of the order 0.655 M (where M is the vacuum nucleon mass) what is also directly connected with the proper value of the nuclear spin-orbit force, at the same time this fact emphasizes the dynamical nature of the nuclear relativity. It is shown that the saturation, the fundamental nucleus property, is a relativistic effect connected with accounting for the small component of the nucleon relativistic single-particle wave function.

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