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Energy correlation of bottom quarks from decays of top quarks in electron-positron annihilation at high energy

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The purpose of the work is to study polarization effects in the presence of CP violation in the process of e^+e^- annihilation with a focus on the future electron-positron collider CLIC with energy $\sqrt{s} = 380$ GeV. The study is primarily focused on the annihilation of electron-positron pairs into top quark pairs, which, upon decay, produce bottom quarks and W bosons. The Lagrangian describing the interaction of quarks with carrier particles such as photons and Z bosons was modified to account for CP-violation effects by including terms proportional to the electric and weak dipole moments.

As a result, the cross-section of the process was obtained as a function of several important variables, such as the energies of bottom quarks and electrons, the polarizations of the initial electron beams, scalar and pseudo-scalar interaction constants of the Higgs boson with top quarks, which determine the appearance of CP disturbance effects. The asymmetry in the number of events in which the energies of bottom quarks are measured in experiments compared to the energies of anti-bottom quarks was analyzed. The physical aim is to detect differences between the number of events in which the energy of the bottom quark is greater than the energy of the antiquark, and the number of events in the opposite case. The study also took into account the observed difference in average energies between bottom quarks and antiquarks when exposed to varying degrees of polarization in the initial electron beam. These observables are sensitive to the CP-violation.

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