EXACT CALCULATION OF THE FLAVOUR-CHANGING QUARK-HIGGS VERTEX

BY

TAN BOK HOOI
DEPARTMENT OF PHYSICS
FACULTY OF SCIENCE
UNIVERSITI MALAYA

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ABSTRAK

Fungsi verteks $q_i q_j H$ di mana indeks *i* dan *j* merujuk kepada jenis kuark bawah dan *H* pula merujuk kepada zarah Higgs telah dikira dalam konteks model Glashow-Weinberg-Salam (GWS). Pengiraan dibuat dengan menggunakan cara 't Hooft-Feynman. Jisim kuark luaran diabaikan dalam pengiraan ini. Bahagian pengiraan yang menyebabkan sifat infiniti boleh dihapuskan dengan menggunakan satu cara renormalisasi yang terdiri daripada gambarajah pengurangan satu zarah. Cara renormalisasi ini berbeza dengan beberapa pengarang lain yang menggunakan pendekatan Ward-Takahashi. Bagaimana fungsi verteks bergantung kepada jisim zarah Higgs juga disiasat. Apabila jisim zarah Higgs diambil kira dalam pengiraan, faktor bentuk fungsi verteks akan terdiri daripada bahagian nyata dan khayalan. Apabila julat jisim zarah Higgs diambil sebagai $0 \leq m_H \leq 250$ GeV wujud dua titik utama pada $k^2 = 4m_j^2$ dan $k^2 = 4M_W^2$ untuk bahagian nyata dan khayalan. Bahagian khayalan adalah bertanggungjawab terhadap asimetri kadar pereputan. Tanpa mengambil kira jisim zarah Higgs, kadar pereputan $q_i \to q_j H$ dan $q_i \to q_j e^+ e^-$ dikira. Pereputan zarah Higgs kepada pasangan kuark-antikuark $(H \to q_i \bar{q}_j)$ juga disiasat. Siasatan ke atas asimetri pelanggaran-CP untuk proses pereputan zarah Higgs kepada pasangan kuark-antikuark iaitu $H \to s\bar{d}$ dan $H \to d\bar{s}$, $H \to b\bar{d}$ dan $H \to d\bar{b}$ serta akhirnya $H \to b\bar{s}$ dan $H \to s\bar{b}$ juga dijalankan.

ABSTRACT

The vertex function of $q_i q_j H$ where the indices i and j refers to the down type of quarks and H refers to the virtual Higgs boson is calculated within the framework of the Glashow-Weinberg-Salam (GWS) model. The calculation is done in the 't Hooft-Feynman gauge where the external quark masses and the mass of the Higgs boson have been neglected. The divergence in the vertex function is eliminated by using a renormalization scheme which consists of one-particle reducible diagrams. The renormalization scheme differs from several other authors who used the Ward-Takahashi approach. The dependence of the vertex function with respect to the mass of the Higgs boson is also investigated. When the mass of the Higgs boson is taken into consideration, the form factors of the vertex function will consist of the real and imaginary parts. When the range of the mass of Higgs boson is taken to be $0 \leq m_H \leq 250$ GeV there exist two thresholds at $k^2 = 4m_j^2$ and $k^2 = 4M_W^2$ for the real and imaginary parts. The imaginary part is responsible for the decay rate asymmetry. Without taking the mass of Higgs into consideration, the decay rate of $q_i \to q_j H$ and $q_i \to q_j e^+ e^-$ are calculated. The Higgs boson decaying into quark-antiquark pair $(H \to q_i \bar{q}_j)$ is also investigated. The investigation of the CP-violating asymmetry for the process of Higgs decay into quark-antiquark pair where $H \to s\bar{d}$ and $H \to d\bar{s}$, $H \to b\bar{d}$ and $H \to d\bar{b}$ and finally $H \to b\bar{s}$ and $H \to s\bar{b}$ are also carried out.

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