# 総合研究大学院大学高エネルギー加速器科学研究科
# ５年一貫制博士課程入学試験問題
# 英　語

令和元年８月２１日（水）１１時２０分～１２時００分

注意

☆ 答案用紙の所定の欄に，受験番号，氏名を記入すること．

☆ 試験問題（３問）ごとに，異なった答案用紙を使用すること．

☆ 各問題に対して，答案用紙は複数使用してよいが，第○○問□□枚目というように，所定の欄に，選択した問題の番号及び答案用紙の順番を記入すること．

解答できない場合も，受験番号，氏名，問題番号を記入し，提出すること．

☆ 答案用紙がさらに必要な場合は，挙手をして監督者に知らせること．

問題は次頁

**第 1 問**

以下の英文を読み，下線部 (1)，(2)，(3) をそれぞれ和訳しなさい．

Modern particle physics started in 1935 when Fermi and Yukawa proposed theories of weak and strong interactions, respectively. (1)The 40-year saga in the quest for the ultimate form of matter and the interactions that govern them culminated in the Standard Model (SM) of particle physics in the early 1970s.

Nearly 50 years have passed since the SM was established. It is a miracle that it still holds the status as the ultimate theory of matter at the most fundamental level. No experimental observations that contradict the SM have been discovered, with perhaps one exception. Even the neutrino oscillation, the exception, may be considered as a small extension of the SM that does not need modifications. As the theory of relativity and quantum mechanics were born as a result of searches beyond Newtonian mechanics and electromagnetism, we expect that a new physics exists beyond the SM.

The SM established a prescription to unify forces by way of the gauge symmetry and spontaneous symmetry breaking. The grand unified theories, the super-gravity, and the string theories were developed as extensions of the SM. Problems were pointed out and hints and new ideas have been suggested in developing the unified theories. The hierarchy is an outstanding problem among them. Many theoretical ideas including the super-symmetry and the extra dimension have been proposed to solve the problem. Most of them suggest a new physics at the teraelectronvolt (TeV) energy scale.

It has also been pointed out from the very beginning that the SM will lose its predictive power on phenomena beyond the TeV energy range (or $\sim 10^{-19}$ m in size). This is because the dynamics of the Higgs that causes electroweak phase transition below $\sim 1$ TeV is unknown. (2)The SM also established a notion that discovery of a new particle is synonymous with the discovery of a new physics. Therefore, experimental searches for new particles in the hitherto unexplored energy region, epecially in the TeV range, are the most orthodox way to explore the physics beyond the SM.

On the other hand, experiments at energy scale in the range $10^{10} \sim 10^{19}$ GeV are required to probe the physics of the unified theories. They are beyond the reach of present-day technology. (3)Fortunately, the advent of the unified theories found a way to elucidate the history of early universe. Cosmology and particle physics have become one and the same scientific field. Conversely, the advent of cosmology opened a new window to view and probe the high-energy phenomena that are inaccessible by today's technology. We can probe properties of particles by looking at cosmic relic particles, fossiles of the Big Bang, so to speak. Nowadays, researches in particle physics that do not rely on accelerators occupy an important branch. They are generally referred to as *non-accelerator physics*. It is an unappealing name, nonetheless used for the reason that no other has been invented.

saga : 物語，　fossile : 化石

出典:Yorikiyo Nagashima "Beyond the Standard Model of Elementary Particle Physics" 序文より引用（一部改変）

**第２問**
以下の日本文を英訳しなさい．

測定の正確さ（accuracy) とは測定結果がどれくらい真の値に近いかを意味する．一方，測定の精密さ (precision) とは測定結果がどれくらい厳密に決められるかを意味する．

**第３問**
あなたが現在行っている研究の進行状況について，一週間後の打ち合わせで報告するよう企画者 (organizer) から依頼がありました．以下の項目が明確に企画者に伝わるような電子メールの返事を英語で作成しなさい．なお，あなたの名前は Ichiro であると仮定します．

- 報告の依頼を引き受けること．
- 発表に割り当てられた時間を教えて欲しいこと，また可能なら打ち合わせ全体のプログラムを教えて欲しいこと．
- 報告のタイトルを打ち合わせ２日前までに企画者に知らせること．