Development of Fusion Science via the Large Helical Device Project

H.Yamada

National Institute for Fusion Science
322-6 Oroshi-cho, Toki, Gifu 409-5292, Japan

Abstract. In this lecture, it is emphasized that sufficient resolution of scientific issues for a fusion energy reactor can be given by complementary studies. Here it should be noted that this lecture is focused on magnetic confinement. Key scientific issues for a fusion energy reactor and ITER addressed by a complementary study in the Large Helical Device (LHD) are discussed. It should be noted that ITER is definitely a necessary condition but not a sufficient condition. Helical systems including stellarators and heliotrons are defined as alternative concepts. These approaches also aim at a fusion energy reactor based on their own concept and simultaneously benefit progress in tokamaks, more specifically ITER itself. The exact science to manage a 3-D geometry has been being developed in helical systems. A physical model with much accuracy and breadth will demonstrate its applicability to ITER. Topics to validate "complementary" approaches such as 3-D equilibrium, interchange MHD mode, control of radial electric field & structure formation, dynamics of a magnetic island, density limit and edge plasmas are discussed. Complementary is not Supplementary. ITER is complementary to development of a helical fusion energy reactor as well. Complementary approaches transcend existing disciplinary horizons and enable big challenges.