磁约束核聚变进展和国际热核聚变实验堆 ITER

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摘要：经国际聚变界近 40 年的共同努力，在磁约束托卡马克核聚变装置上，开发聚变能源的科学可行性已被实验证实。在此基础上，经过 20 多年的论证、研发和总体设计，一个预期可实现聚变功率 40 万千瓦，功率增益达到 10，燃烧时间 400~3000 秒的国际热核聚变实验堆（ITER）已由七个国家和组织（中、美、日、韩、印度、俄罗斯、欧盟）正式开始合作建造。ITER 项目的启动不仅反映磁约束聚变已经取得了重要进展同时也表明在向实用能源推进的过程中实现稳态、高参数燃烧聚变等离子体是其最重要的科学目标。这一科学目标的实现将为进一步建造多种实用聚变堆奠定坚实基础。全超导托卡马克是实现这一科学目标最重要的工程技术基础。在 ITER 建成之前，中国在国际上率先建成全超导托卡马克，它和国内其它实验装置一起，将为 ITER 的成功运行和实验做出重要贡献，也将为中国下一步聚变能源的开发研究奠定人才、工程技术和物理基础做出贡献。
关键词：核聚变；磁约束；托卡马克；国际热核聚变实验堆 ITER

Progress on Magnetic Confinement Fusion Research and International Thermo-nuclear Experiment Reactor（ITER）

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Abstract: The significant progress on magnetic confinement fusion device tokamak has been achieved with the great effort by world wide fusion community for almost 40 years: the scientific feasibility for fusion energy on tokamak has been demonstrated experimentally. Based on the progress and the efforts of the conceptual design and successful R&D activities for more than 20 years the International Thermo-nuclear Experiment Reactor (ITER) has begun for construction under the largest international collaboration agreement by seven partners (China, US, Japan, Korea, India, Russia and EU). Q* = 10, Fusion power P ~ 400 MW with "burning" time 400 to 3000 seconds will be achieved. The goal of ITER will be to achieve long pulse or steady state burning plasma with high performance. The success of ITER will construct the important base of future Demo and fusion power plant. The full superconducting tokamak is one of the most important engineering and technical bases of ITER. Before the ITER China has built the first full supercond6cting tokamak EAST in the word. It as well as other Chinese tokamaks will make important contribution on the education of scientists and engineers and the technical, engineering, physics basis of further development of fusion research in China,
Key words: Nuclear fusion; Magnetic confinement; Tokamak and ITER