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# 光学 / 红外望远镜和技术的进展

苏定强　　崔向群

(中国科学院南京天文仪器研制中心　南京　210042)

## 摘　要

天文望远镜和技术在 20 世纪末取得了空前的辉煌成就，并将取得更辉煌的成就：(1) 大型望远镜的研制：口径 10m 的两架 Keck 望远镜已分别在 1994 年和 1996 年投入工作。ESO VLT 四架 8m 望远镜中的第一架已在 1998 年 First light, 最后一架也将在今年内 First light．两架 Gemini 8m 中的一架和一架 Subaru 8m 望远镜都已完成。HET 9m 望远镜正在最后调试。由两个 8m 望远镜组成的 LBT 将于 2004 年完成，一架 10m(复制的 Keck) 和一架 9m(复制的 HET) 望远镜正在研制中。这些望远镜已配备或将配备先进的光学、红外 CCD 照相机和光谱仪，如 Keck 的 NIRSPEC 、 VLT 的 FORS 、ISAAC 等。巡天计划中 SDSS 、 2dF 、 2MASS 和 DENIS 仪器已完成，都已投入观测。LAMOST 正在积极研制中， VISTA 即将开始研制。现在 CalTech 等已开始研制口径 30m 的极大望远镜 (ELT)，ESO 和 NOAO 已开始了口径 100m 望远镜的预研，中国和英国也提出了很好的 ELT 方案。(2) 探测器的改进：当前 CCD 的量子效率 $QE$ 蓝片已达 70% ~ 80%，红片已达 90%，已投入使用的最大的拼接的 CCD 为 12k×8k，几个 8k×8k 的 CCD 已用在望远镜上。当前 20k×18k 的拼接的 CCD 正在研制中。天文观测上 CCD 已取代了照相机底片。红外波段 HgCdTe 1k×1k 的 CCD 已投入工作， 2k×2k 的正在研制中。(3) 光干涉系统的进展：多个光干涉系统已投入观测并取得了一系列天文成果，如：GI2T，COAST、IOTA，NPOI，PTI、ISI、SUSI、MIRA；一些光干涉系统正在发展中，如：CHARA 、 MRO 、 LBT；特别是两架 Keck 望远镜、四架 VLT 都配以一些较小的望远镜组成巨大的干涉阵，前者最长基线 140m，后者 200 m，将在今后的数年内完成并投入观测。(4) 自适应光学系统的应用：许多 3 ~4m 级的望远镜已配置或正在研制相应的自适应光学系统，红外和可见光波段的衍射极限的像已在 3 ~4m 级的望远镜上获得， Keck 和 ESO 都正在发展用于 10 m 和 8 m 望远镜的自适应光学系统。正在研制和预研中的 30 m 到 100 m 口径的望远镜也都配有自适应光学和光干涉系统。

注：本报告以 Mclean I S 等执笔的 IAU Commission 9 三年进展报告 (见： Reports on Astronomy 1996~1999, IAU Transaction, Vol.24A, p.316~327) 为蓝本，补充扩大而成。

**关 键 词**　天文望远镜 — 天文技术 — 探测器

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# Progress of Optical/IR Telescopes and Techniques

Su Dingqiang　　Cui Xiangqun

*(Nanjing Astronomical Instruments Research Center, Chinese Academy of Sciences, Nanjing 210042)*

*(National Astronomical Observatories, Chinese Academy of Sciences, Beijing 100012)*

## Abstract

The content of this report is based on the report of the IAU Commission 9 for 1996-1999

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written by L.S.Mclean, (see Report on Astronomy 1996-1999, IAU Transaction Vol. 24A, P. 316-327), and with some more complementarity.

The last decade of the 20th century was an unprecedented splendid time for astronomical telescopes and techniques, and more splendid achievements will be created since then. (1) Telescopes: Two 10 m Keck telescopes have been in operation since 1994 and 1996 in sequence. The first telescope of the four 8 m telescope project—ESO VLT got its first light in 1998, and the last one is going to get its first light soon this year (in 2000). One of the two 8 m telescopes of Gemini project and Subaru 8 m telescope have both been completed recently. HET 9 m telescope is in its commissioning stage. LBT, which is composed of two 8 m telescope tubes, is going to be completed in the year of 2004. There are one 10 m telescope (copied from Keck) and one 9 m telescope (copied from HET) still in manufacturing. These telescopes have been equipped or are going to be equipped with advanced optical, infrared CCD cameras and spectrographs. For example, there are NIRSPEC in Keck, and FORS and ISSAC in VLT. In sky survey projects: SDSS, 2dF, 2MASS and DENIS have been completed and all are in observation. LAMOST is under its active development. The concept design of VISTA has been started already. CalTech has started the concept design of the 30 m Extremely Large Telescope (ELT). ESO and NOAO have started the concept design of the 100 m telescopes respectively also. China and Britain have proposed some very good concept designs of ELT respectively too. (2) Detectors: The quantum efficiency (QE) of CCD now is 70% $\sim$ 80% for blue-optimized chips and 90% for red-optimized chips. The largest CCD mosaics which have been used in observation is 12k $\times$ 8k. There are several CCD with dimension 8k $\times$ 8k which have been equipped in telescopes. CCD mosaics with 20k $\times$ 18k is under development. It is no doubt that the photographic plate has been replaced by CCD in astronomical observation now. In infrared band, 1k $\times$ 1k HgCdTe CCD has been used in observation and 2k $\times$ 2k is being developed. (3) Interferometry: There are several interferometer systems which have been in operation and have got some extensive astronomical results, for example, GI2T, COAST, IOTA, NPOI, PTI, ISI, SUSI, MIRA. Development of some interferometers is under way or nearly completed, for Example, CHARA, MRO, LBT. Especially two 10 m Keck and four 8 m VLT with some small telescopes will all form a very big interferometer array. The Keck interferometer is with a 140 m maximum baseline, and the maximum base line of VLT interferometer (VLTI) will be 200 m. Both will be in operation soon in the nearest future. (4) Adaptive optics: Adaptive optics is being equipped in many 3 to 4 m telescopes. Diffraction-limited optical and infrared imaging from ground is now obtained. Keck and ESO are both developing adaptive optics, which will be used in 8 to 10 m telescopes. All proposed 30 to 100 m Extremely Large telescopes will include adaptive optics too.

**Key words** astronomical telescope—Astronomical technique—detector

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