

贝尔巨星 华人骄傲

Bright Star from Bell Labs Great Pride of all the Chinese

——厉鼎毅先生纪念画册

Commemorative Album of Dr. Tingye Li



*In order for me to have vision,
I had to stand on the shoulders
of the giants in the field.*

DR. TINGYE LI

主编 任晓敏
Chief Editor Xiaomin Ren

副主编 张泳 徐坤
Associate Editors Yong Zhang Kun Xu

顾问 范崇澄
Consultant Chongcheng Fan



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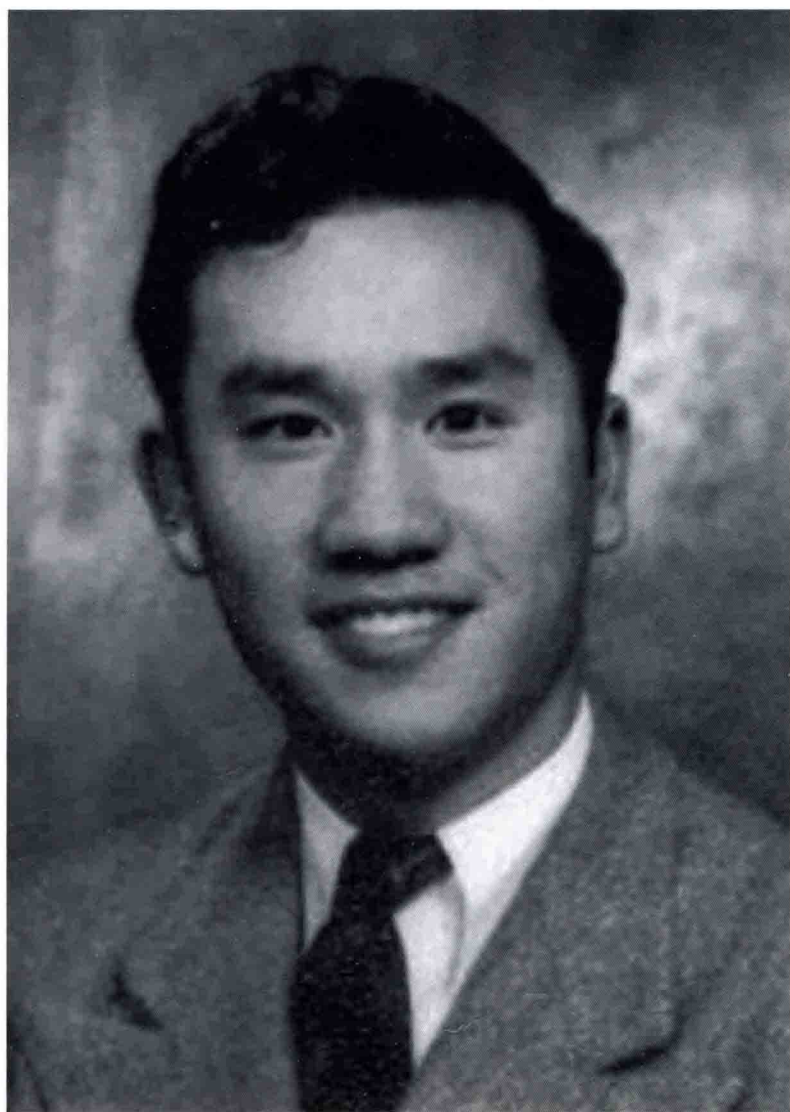
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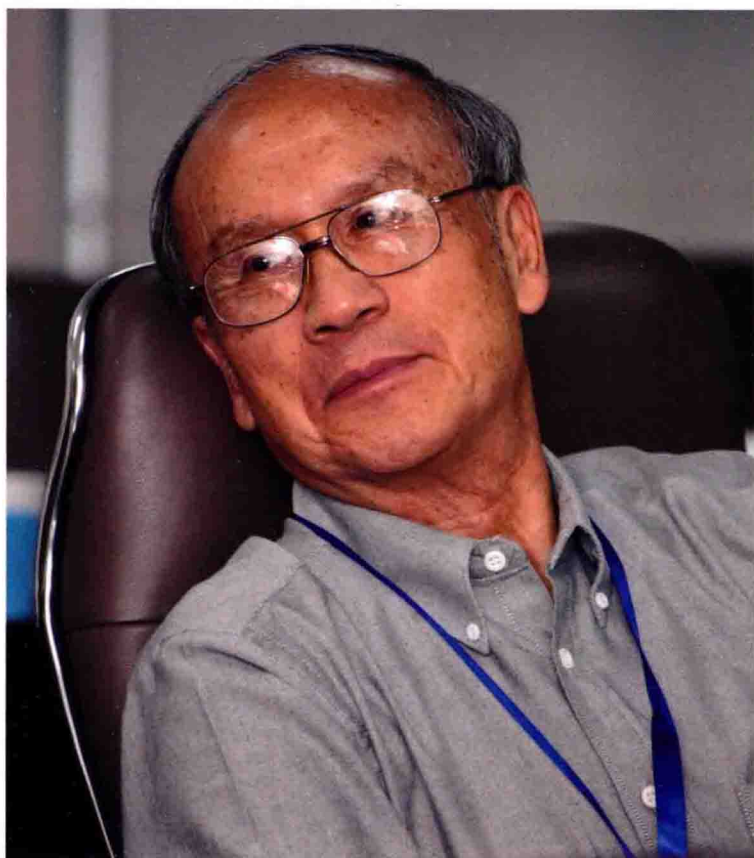
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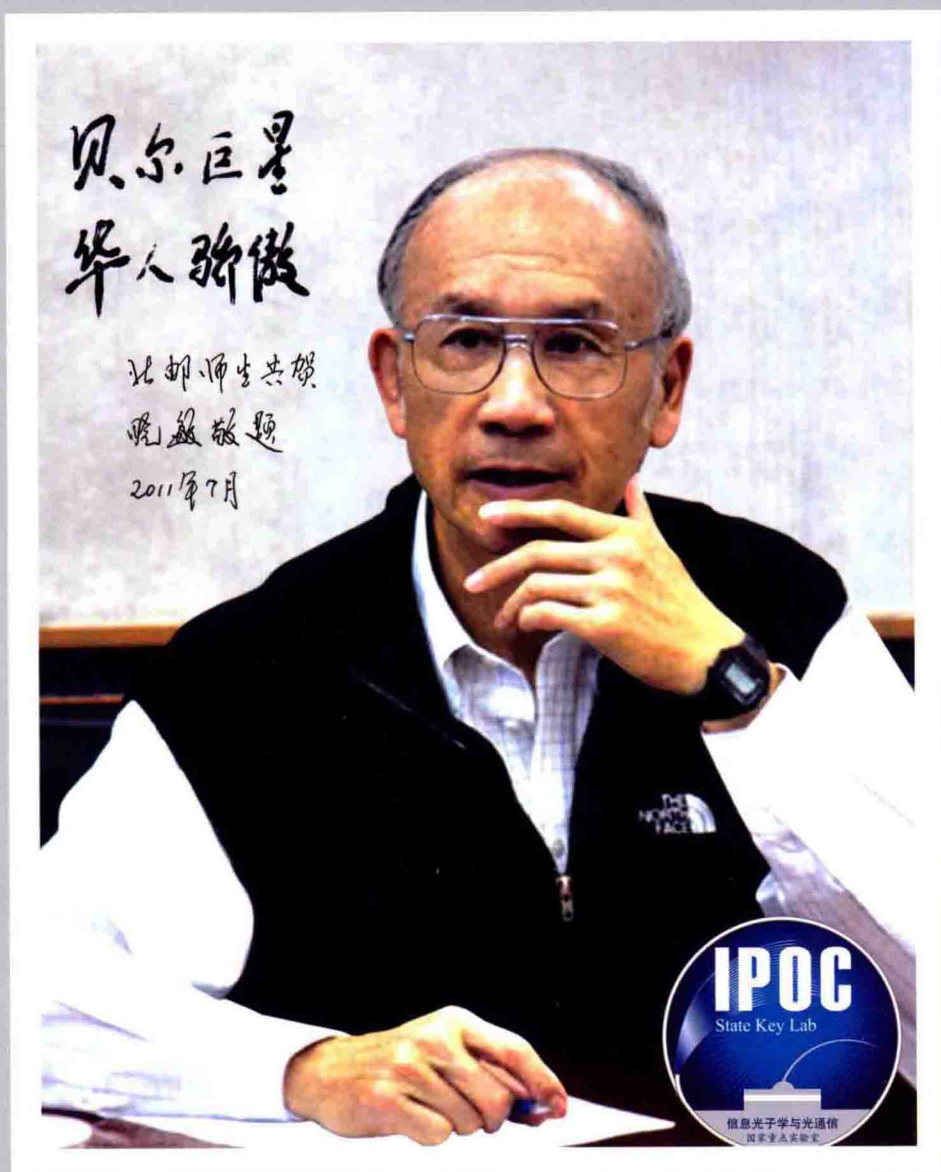
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Bright Star from Bell Labs Great Pride of All the Chinese

A Specially Made 3D Portrait Presented by BUPT

Inscription and Calligraphy by Xiaomin Ren

July, 2011

序言

2012年12月27日，世界著名光通信专家、“波分复用之父”厉鼎毅先生仙逝于美国犹他州。这是光通信乃至整个信息技术领域的巨大损失。近一年来，世界各地的同行们多次举办活动纪念和缅怀这位可敬可爱的学术先驱，崇敬之情彰溢。时值ACP 2013 国际会议在北京举行之际，编辑出版这本纪念册，旨在深切怀念厉先生的品德和学养，以激励我们为人类科学技术的发展作出更大的贡献。

厉鼎毅先生1931年出生于江苏南京，年轻时接受了东西方文化交融并重的教育，1957年于美国西北大学获博士学位，而后在著名的贝尔实验室供职41个春秋。在其漫长而杰出的职业生涯中，厉先生对天线、微波、激光和光通信等领域都作出了卓越的贡献，是光通信行业举世公认的学术领袖。厉先生早年在激光谐振腔和激光模式方面的研究成果为激光器在光通信中的应用奠定了基础；而后，他又研发了世界上第一个WDM波分复用系统，并首先提出在波分复用系统中使用光放大器等诸多关键技术路线。这些先导性工作为在世界范围内建设超大容量的信息高速公路提供了巨大的推动力，具有划时代的革新意义。随着光通信技术和产业的蓬勃发展，厉先生以其非凡的成就蜚声中外，一生被授予无数奖项，并于1995年就任美国光学学会主席，1996年当选中国工程院外籍院士。

厉鼎毅先生对中国光通信事业的发展格外关注。自1985年以来，他先后60余次回到祖国大陆访问、讲学，曾担任国内多所知名大学的名誉教授，并多次介绍著名的外国科学家来中国交流。他对中国光通信技术和产业的发展提出了许多极为重要的指导意见，为祖国科学技术的进步作出了不可磨灭的贡献，同时他还为发展中美通信事业的合作付出了巨大的热忱和心血。需要特别提到的是：厉先生是ACP及其前身APOC国际会议的主要倡导者和杰出组织者。直到生命的最后时刻，他还在关心着ACP 2013的筹备工作。

通信泰斗，良师益友；巨人虽逝，丰碑长存！厉鼎毅先生光辉一生之于时代和历史的意义是非凡的，而这种意义在其激励未来的作用方面，也许比单纯的令人仰慕的成就方面还要大。

谨以此序再次向厉鼎毅先生致以深深的敬意！



2013年8月

Preface

Dr. Tingye Li, a world famous optical communications expert, the father of wavelength division multiplexing (WDM) technology, passed away on December 27th, 2012 in Snowbird, Utah. This is a great loss to the field of optical communications and even to the whole field of information technologies. Since then nearly one year passed, the world counterparts held many activities to commemorate and recall this adorable academic pioneer for expressing their respect. Asia Communications and Photonics Conference (ACP) 2013 will be held in Beijing, on this occasion, editing and publishing of this commemorative album is in order to deeply memorialize Dr. Li's character and scholarship, and to inspire us to make greater contributions to the development of human science and technology.

Dr. Tingye Li was born in 1931 in Nanjing, Jiangsu Province, China. He was educated in the environment of cultural exchange between eastern and western when he was young. In 1957, he obtained his Ph. D. from Northwestern University. After that, he joined the famous Bell Labs, AT&T, and worked there for 41 years. In his long and illustrious career, Dr. Li made significant contributions to the fields of antennas, microwave propagation, lasers and optical communications, and it is universally acknowledged that he is an academic leader of optical communications industry. Dr. Li's early years research in the laser cavity and laser pattern laid a foundation for the application of laser in optical communications. After that, he and his team developed the world's first WDM system and first proposed many routes for key technologies such as using optical amplifiers in WDM system. These pioneering achievements provide huge impetus to construct large capacity information highway worldwide, and are considered to have revolutionary significance in the history of optical communications. With the rapid development of optical communications technology and industry, Dr. Li is renowned both at home and abroad for his remarkable achievements, and he also received many awards and honors during his long and distinguished career. He became the chairman of the Optical Society of America in 1995, and was elected as foreign academician of the Chinese Academy of Engineering in 1996.

Dr. Tingye Li has always been concerned to the development of China's optical communications industry. Since 1985, he has visited the mainland more than 60 times to give lectures. He was invited as honorary professor by many famous universities in China, and has introduced many famous foreign scientists to come to China for communication. He put forward many important suggestions on the development of China's optical communications technology and industry, made an indelible contribution to the development of China's science and technology. Moreover, he made great efforts for the development of Sino-US communication business cooperation. In particular, Dr. Li is an outstanding organizer and advocator of ACP and its predecessor APOC International Conference. Even at the last moment of his life, Dr. Li was still greatly concerned about the preparations for ACP 2013.

A telecommunication giant and a kindly mentor, a perished master with an imperishable monument! Dr. Tingye Li's glorious life has extraordinary significance for the age and history, and his effect of inspirations to the future generation maybe has much greater significance than his other admirable achievements.

This preface is written to express my deepest respect to Dr. Tingye Li again!

Bingkun Zhou
August 2013

通信泰斗，良师益友
巨人虽逝，丰碑恒久

永远怀念厉鼎毅先生！

清华大学 周炳琨

2013.8

**A telecommunication giant and a kindly mentor;
A perished master with an imperishable monument.**

We always cherish the memory of Dr. Tingye Li!

Bingkun Zhou, Tsinghua University

周炳琨

中国科学院院士、中国光学学会理事长、中国国家自然科学基金委员会原副主任、清华大学教授

Bingkun Zhou

Academician of Chinese Academy of Sciences (CAS)

President of The Chinese Optical Society (COS)

Former deputy director of National Natural Science Foundation of China

Professor of Tsinghua University

深切怀念厉鼎毅先师
通信因您添光彩 鼎销辉煌
宽带感君领开拓 毅力永恒

晚生 邬贺铨
2013.8.22

Deeply cherishing the memory of the deceased master, Dr. Tingye Li
Telecommunication has been so brilliant owing to your accomplishment;
Broadband Innovation had been directed by you with eternal perseverance.

Yours disciple, Hequan Wu

邬贺铨

中国工程院院士、中国工程院原副院长

Hequan Wu

Academician and Former Vice-President of Chinese Academy of Engineering (CAE).

追思 厉鼎毅先生
横模立论铸业基，
分波呼啸树传奇。
网联天下功谁问？
四海空无忆吾师。

曹健林

祭已深秋

“呼啸”指厉先生带领团队于Roaring Creek
成功地进行的历史性高速波分复用传输实验。

Recalling Dr. Tingye Li

The work on transverse laser modes
paved the way for IT developments;
The legend of WDM began
in Roaring Creek, a heroic place.
Who made the global networking possible?
Cherished by the worldwide telecommunication community
are my beloved mentor and his contributions.

Jianlin Cao, Late Autumn, 2013

“Roaring” refers to the historical high speed WDM transmission experiment done
by Dr. Li and his team at Roaring Creek.

曹健林
中国科学技术部副部长
Jianlin Cao

Vice Minister of Ministry of Science and Technology of the People's Republic of China.

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Achievements and Accomplishments

成就与造诣

激光科学的先驱

厉鼎毅先生与他人合作发展了关于激光谐振腔的至关重要的早期认识，对基于激光器的光纤通信作出了先驱性的贡献。1961年，他和同事Gardner Fox合作发表的标志性论文 *Resonant Modes in a Maser Interferometer*，首次预测了激光器谐振腔中的不同横向模式，奠定了激光器理论和实践的基础。

LASER MODE THEORY

Calculation of laser resonator modes by computer simulation

Resonant Modes in a Maser Interferometer
By A. G. FOX and TINGYE LI
(Manuscript received October 20, 1960)
The Bell System Technical Journal, Vol. 40, pp. 453-488, March, 1961

- During 1958-9, laser pioneers speculated on laser modes in an open resonator *
- In 1959, we obtained the lowest-order modes through iterative computation of the reflected electro-magnetic fields on the laser resonator mirrors **
- Equivalent to solving an eigenvalue problem by the method of iteration
- Since the kernel of the integral equation is non-Hermitian (lossy system), no rigorous solution was known to exist then
- Our approach was based on physical insight and engineering intuition
- Rigorous existence proof of the solution was obtained in by mathematicians in 1964
- The above seminal work established the basis of laser mode theory

OSA 09 TLI

* First (ruby) laser was demonstrated in 1960
 ** First published in Proc. IRE, Nov. 1960

激光模型理论

“这篇论文为我们理解不同模式在激光谐振腔中的表现和激光谐振腔的设计奠定了基础。”

——美国光学学会（OSA）

“它使得激光器从一个‘伟大发明’转变成了‘实用的通信平台’。”

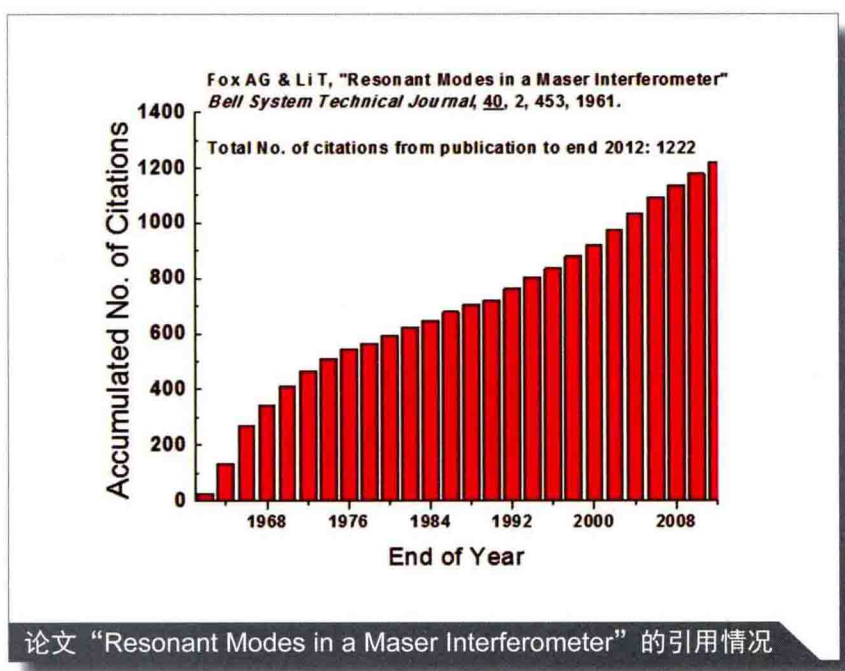
——Arno Penzias（诺贝尔物理学奖获得者）

“没有多少论文帮助定义一个场，但这是其中之一。”

——Alan Willner（英国皇家工程院院士、原IEEE LEOS主席、美国南加州大学教授）

PIONEER IN LASER SCIENCE

Dr. Tingye Li collaborated in developing crucial early understanding of laser cavities and subsequently made pioneering contributions to laser-based communication through optical fibers. In 1961, Dr. Tingye Li and his colleague, Gardner Fox, published their iconic paper *Resonant Modes in a Maser Interferometer*, which for the first time, predicted the different transverse modes in laser resonate cavities. The Fox and Li's paper was fundamental to the theory and practice of lasers.



This paper established the basis for the understanding of the design of optical resonators and how modes in optical resonators behaved.

— OSA

It helped transform the "wonderful invention" of the laser into "a practical communications platform."

— Arno Penzias

There aren't many papers that help define a field, but this was one of them.

— Alan Willner

WDM之父

20世纪80年代末，厉鼎毅先生及其团队在贝尔实验室开发了全球第一套WDM（光波分复用）系统。他指导他的团队致力于波分复用系统中光放大器的研究与实现，使得光纤容量可通过增加信道数目创建虚拟光纤而得到提升。WDM和光放大器的使用改变了网络经济学范式，被认为在光波通信的历史上具有划时代的革命意义。在WDM技术问世后的几年里，光纤系统的传输容量得以按指数增长，从而成就了今天的互联网。厉鼎毅先生被公认为WDM之父。

“厉鼎毅塑造了我们今天所知的光波网络基础设施。”——在为他颁发2009年爱迪生奖章时，IEEE如此评价他。

THE FATHER OF WDM TECHNOLOGY

In the late 1980s, Dr. Tingye Li and his team developed the world's first WDM (Wavelength Division Multiplexing) system at AT&T Bell Labs. He directed his team to study and implement the use of optical amplifiers in WDM systems, which utilized the existing embedded base to create virtual fibers by putting more channels onto a single fiber. The use of WDM and optical amplifiers changed the paradigm of network economics and is considered to be of revolutionary significance in the history of lightwave communications. In the several years after the inception of WDM technologies, transmission capacities inside optical fibers increased exponentially, making today's Internet possible. Dr. Tingye Li was regarded as the father of WDM technology.

“Tingye Li has shaped the lightwave network infrastructure we know today.”— IEEE said when presenting him with its Edison Medal in 2009.

