Active integrated optics

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Integration of a variety of optical and electronic components monolithically on a single chip of substrate is the goal of integrated optics. During the past few years a lot of effort has been put into the development of individual optical devices such as low-threshold single-mode GaAs lasers, waveguides, modulators, etc. On the other hand, a great amount of progress has also been made on the high-speed GaAs electronic devices such as FET's, Gunn oscillators, etc. However, the integration of these two kinds of devices has not been achieved. Recently, we succeeded, for the first time, in fabricating GaAs heterostructure lasers on semi-insulating substrates. Because of the nonconductive substrate, the electrical integration can be performed on epilayers, and hence becomes much easier. In the paper we report the integration of a GaAs-GaAlAs injection laser with an electronic device — Gunn oscillator — on the same chip of substrate.

We also describe the integration of a number of different double heterostructures (DH) injection lasers and GaAs transistors including MESFETS and bipolar GaAs transistors. The last example will deal with a complete monolithic optical repeater including an optical detector, a MESFET current amplifier and a DH laser on a single chip. The talk will also address the basic physical limitation of the high frequency modulation limitation of GaAs injection lasers.

有源集成光学

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在单块基片上将各种光学元件和电子学元件集成为一体是集成光学的目标。过去几年内在各光学器件的发展上曾进行了大量的工作，这些器件包括低阈值单模 GaAs 激光器、波导、调制器等。另一方面，诸如场效应晶体管、耿氏振荡器等高速 GaAs 电子器件亦已获得显著的进展。然而，这两种器件的集成尚未获成功。最近我们首次成功地在半绝缘基片上制成了 GaAs 异质结激光器。由于基片是非导体，电子集成可在外延层上实现，工艺就简单得多。本文报导 GaAs-GaAlAs 注入激光器与一耿氏振荡器电子器件在同一块基片上的集成。

本文还要介绍各种双异质结构(DH)注入激光器和 GaAs 晶体管(包括 MESFETS和双极 GaAs 晶体管)的集成。最后一个例子讨论由一光检测器、一MESFET 电流放大器和一双异质结结构激光器在一单片上集成的光中继器。还报导 GaAs 注入式激光器高频调制极限的基本物理原理。