

Applications of high resolution laser spectroscopy

Herbert Walther

(Sektion Physik, Universität München and Projektgruppe für Laserforschung der
Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.v.,)

D-8046 Garching, Tel.: (089) 3209-5142

Dye lasers are a very useful tool for the investigation of the kinetics of chemical reactions. In crossed beam experiments the reactions of CH_3I , CF_3I and ICl with F atoms and the reactions of alkaline dimers with O atoms were investigated. The laser induced fluorescence of the reaction products allows a detailed analysis of the reaction kinetics. Furthermore spectroscopic studies on the molecule-surface interaction have been performed. For these experiments a molecular beam was scattered at the surface and the internal state distribution of the scattered molecules was investigated by laser induced fluorescence.

In the second part of the talk a quantum detector for submillimetre radiation using Rydberg atoms will be described. The Rydberg states have been populated using cw dye lasers. To reduce the influence of the background radiation the beam of Rydberg atoms was surrounded by a shield cooled to a temperature of 14 K. With stabilized dye lasers a NEP of $10^{-19} \text{ W} / \sqrt{\text{Hz}}$ can be achieved.

高分辨率激光光谱术的应用

Herbert Walther

(慕尼黑大学物理系, 马克斯-普朗克协会激光研究筹备组)

染料激光器是研究化学反应动力学的一种十分有用的工具。采用交叉束流的实验, 研究了 C_3I 、 CF_3I 和 ICl 与氟原子的反应以及碱二聚物与氧原子的反应。用反应产物的激光感生荧光可以对反应动力学作出细致的分析。此外, 还进行了分子-表面相互作用的光谱学研究。在这些实验中, 分子束在表面上散射并利用激光感生荧光研究了散射分子的内部状态分布。

本文第二部分叙述了利用里德伯原子作为亚毫米辐射的一种量子探测器。用连续染料激光器使里德伯态粒子数增加。为了减少本底辐射的影响, 里德伯原子束用一个冷却到 14K 的屏蔽罩围住。使用稳定的染料激光器, 噪声等效功率 (NEP) 可以达到 10^{-19} 瓦/赫^{1/2}。