

## 论文

### $^{87}\text{Rb}$ $D_1$ 线法拉第反常色散光学滤波

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摘要:

为了得到在高背景噪音下对弱信号光的提取, 实验研究了基于 $^{87}\text{Rb}$   $D_1$  线 $5S_{1/2} F=2 \rightarrow 5P_{1/2} F=1$  跃迁的795 nm 法拉第反常色散光学滤波器. 充铷的样品池所含 $^{87}\text{Rb}$  的比例高于自然铷, 样品池处在均匀的磁场中并且夹在两个相互正交的偏振片之间. 入射的探测光通过样品池, 与原子相互作用, 由于法拉第旋转效应实现滤波功能. 改变实验条件, 透射结果随之明显变化. 当温度从340 K 升高到360 K, 透射谱的变化情况被细致记录, 并且分析了导致透射情况变化的原因. 在适当的工作温度以及磁场条件下, 得到线宽为约220 MHz 的超窄带透射谱线, 谱线透过率约为48%.  $^{87}\text{Rb}$   $D_1$  线的实验结果优于 $^{85}\text{Rb}$  的吸收线.

关键词: 滤波器 反常色散 超精细结构 法拉第旋转

### Faraday Anomalous Dispersion Optical Filter at the $^{87}\text{Rb}$ $D_1$ Line

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Abstract:

To obtain the weak signal light detection from the high background noise, a study on ultra-narrow bandwidth Faraday anomalous dispersion optical filter (FADOF) at the  $^{87}\text{Rb}$   $D_1$  line,  $5S_{1/2} F=2 \rightarrow 5P_{1/2} F=1$  transmission (795 nm) is demonstrated experimentally. A sample cell filled with Rubidium atoms in which the proportion of  $^{87}\text{Rb}$  is greater than that of the nature rubidium is placed in a homogeneous magnetic field between two crossed Glan-Thompson polarizers. The incident probe light goes through the sample cell, and interacts with the atoms. Because of the Faraday rotation, the function of the filter can be realized. When the experiment condition changed, the result of transmission spectrum changed accordingly. With the temperature rising from 340 K to 360 K, the variation of the transmission spectrum is recorded particularly. And the reason for the variation is analyzed carefully. At a proper temperature and magnetic field, a transmission spectrum narrowed to ~220 MHz is obtained, and the peak transmission is about 48%. The performance of the  $^{87}\text{Rb}$   $D_1$  line is better than that of the  $^{85}\text{Rb}$ .

Keywords: Filter Anomalous dispersion Hyperfine structure Faraday rotation

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