

新穎光學外差偏極計

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摘要

結合外差干涉術與光學偏極計的原理，發展四種新穎的光學外差偏極計，且應用於量測對掌性物質的平均折射率、對掌參數、微小光學旋轉角及散射性對掌性物質等。本論文所提出的新穎光學外差偏極計，都具有高穩定度、高精確度、操作容易與快速量測的優點。

(1) 提出一種新型光學外差偏極計。其特點是利用旋光外差干涉術結合特殊設計且裝置對掌性物質的玻璃盒，使得此偏極計可以同時測量出對掌性物質的對掌參數與平均折射率。

(2) 提出高精確度光學外差偏極計。此偏極計利用放大待測相位差的方式，使得測量光學旋轉角的解析度提高，因此可以用於測量微小的光學旋轉角。

(3) 提出可測量散射性對掌性物質的光學外差偏極計。其特點是利用 post-configuration 的原理，使得光因散射所產生的額外相外差可被去除，如此可精確得到光學旋轉角。

(4) 提出反射式光學外差偏極計。此偏極計利用光入射至對掌性物質介面且入射角接近臨界角時，反射光的 p-與 s-偏光之間的相位差會放大的特性，使得待測相位差放大到可測範圍內，而將對掌性物質的對掌參數與平均折射率求出。

Novel Optical Heterodyne Polarimeters

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ABSTRACT

Based on principles of heterodyne interferometry and optical polarimeter, four novel optical heterodyne polarimeters which can be applied to measure the average refractive index, the chiral parameter, and the small optical rotation angle of a chiral medium and a scattered chiral medium are proposed and evaluated. Namely, they have many merits, such as high stability, high resolution, easy operational endeavor, and real-time measurement.

(1) An optical heterodyne polarimeter which consists of a circularly polarized heterodyne interferometer and a particular glass box containing a chiral medium is developed and it can be used to estimate the average refractive index and the chiral parameter simultaneously.

(2) A high-accuracy optical heterodyne polarimeter is presented. In this interferometer, the phase difference associated to the optical rotation angle is enhanced very abruptly and it becomes detectable with a normal polarimeter. Consequently, this polarimeter can be used to measure a small optical rotation angle.

(3) A common optical heterodyne polarimeter for measuring a scattered chiral medium is improved. Because of its post-configuration, the extra phase difference

induced by scattered media can be eliminated and the optical rotation angle can also be measured accurately.

(4) A reflection-type optical heterodyne polarimeter is demonstrated. The phase difference between p- and s- polarizations of the light reflected from a chiral medium become measurable as the incident angle is just smaller than the critical angle. The average refractive index and the chiral parameter can be estimated with only a small quantity of chiral medium.

