Comparison of Hanle resonances in ^{87}Rb, produced with circularly and linearly polarized pumping light

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Since many decades, atomic vapors have been successfully used for magnetometry in different areas, such as space exploration and geomagnetic surveys. More recently, owing to miniaturization, atomic magnetometers based on the Hanle effect are becoming increasingly popular for biomedical applications. The basic measurement principle relies on optical pumping, which describes the magnetization of atomic vapor through resonant, polarized light fields. The same pumping light or off-resonant probe light is then used for optical read-out of the atomic ensemble's polarization state, which depends on the ambient magnetic field. The Hanle effect describes the special case, where a magneto-optical resonance occurs in the absence of an ambient magnetic field. Therefore, it is also known as a zero-field or Hanle resonance and the associated instruments as zero-field or Hanle magnetometers. The characteristics of the Hanle resonances depend on the polarization of the interacting light field, which has been described by numerous authors [1,2,3]. In this work, we present a parameter study on Hanle resonances for both circular and linear polarization. Characteristics of the resonances, such as amplitude, line width and shape are compared. The aim is to determine the parameter combinations for both polarization states, which optimize the sensitivity in a magnetometer operation.

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