

## ***Interactive comment on “Circular depolarization ratios of single water droplets and finite ice circular cylinders: a modeling study” by M. Nicolet et al.***

### **Anonymous Referee #1**

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### **General comments**

The work that is presented will benefit researchers concerned with the detection and characterization of cloud particles using depolarization measurements. It presents important conclusions concerning the relative merits of using circular as opposed to linear polarization.

The methods used are appropriate for the task, except for a justification for employing circular as opposed to hexagonal cylinders - see below for detailed comments.

The paper will benefit from much more careful subediting. There are numerous stylistic, grammatical and typographical errors. They affect the clarity of the paper. Some are

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listed below.

### **Specific comments**

The Abstract should mention the somewhat negative conclusion concerning the use of circular polarization included at the end of Discussion.

On page 30127 line 29 why is "Right-handed" circular polarization singled out? For non-chiral particles there should be no (statistical) difference between left and right.

The first paragraph in the "Theory" section belongs more properly somewhere in the "Introduction".

Why does the fact that  $\delta_L < \delta_C \leq 2\delta_L$  make the circular depolarization method attractive (page 30131)? Surely the numerical value itself is of little importance; rather, it is the relative strength of the depolarization signal with respect to error sources (multiple or molecular scattering, orientation effects etc.) that determine any advantage.

The Authors cite Baran et al. 2001 in support of the assertion that circular cylinders are an acceptable approximation for hexagonal ones. However, in the cited study randomly oriented crystals were considered, unlike in the present one. Lack of axial symmetry adds a further degree of variability to depolarization, so we can expect a greater spread of values for hexagonal cylinders than for circular ones. Moreover, Baran et al. 2001 were concerned with linear depolarization, not circular. So it would be more appropriate to say that the Authors *assume* acceptability of this approximation for circular polarization. Another approach to this justification is to say that the approximation is valid as far as the *relative* comparison of circular and linear depolarization is concerned (i.e. the results are likely to be valid when considered together with the earlier study of linear depolarization). These caveats must be clearly spelled out here and/or in the Discussion.

The second paragraph on page 30133 needs rewriting to improve clarity, it requires too much effort to decode the meaning. For example, what does "The occurrence also

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indicates a decreasing trend with rising..." mean? What does "more regular and stable" mean, etc?

Further along, what are "mineral dust polydispersed spheres"?!

In Discussion, the authors seem to be suggesting that circular depolarization is used by CALIPSO. This is not so.

#### **Technical corrections**

Abstract, line 14: replace "performing" with "performed".

Page 30126 line 26: replace "about" with "of".

Page 30127 line 10: "detectable" with "detect" and remove brackets.

Page 30128 line 6: "decreasing from" with "less than". Line 20: "permits to distinguish" with "allows discrimination"

Page 30130: Eq. (3) gives **M** for a quarter wave plate with axis at  $45^\circ$ , this should be stated before Eq. (3); also in line 6 replace "follows" with "follow".

Page 30131 line 20: replace "axis-" with "axi". Lines 21-23: the sentence needs correcting; and what is "nominal 405 nm"?

Page 30132 line 20: replace "is" with "are".

Page 30133 lines 18-20: the sentence is a truism! In the following one does "counter-vail if not exceed" mean "counteract or even exceed"?

Page 30134 line 3: it should be "equality". Lines 14-15 should be rewritten (what is "intervals discontinuity"?!). Line 16: replace "illustrated" with "illustrates". Line 18-19: why mention here how  $\delta_C$  is determined? In line 21 is "This is still the case for a  $1^\circ$  departure from exact backscattering" meant? In line 22 replace "but" with "although".

Page 30135: the meaning of the second sentence in the second paragraph ("They assume...") is unclear. Line 15: replace "were able to" with "could".

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Page 30136 line 14: replace "One" with "A".

Winker 1999 reference is not complete.

Figure 1 legend: replace "accurate" with "representative".

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