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Interactive comment on "Observation of an optical anisotropy in the deep glacial ice at the geographic South Pole using a laser dust logger" *by* Martin Rongen et al.

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General comments

The manuscript describes observations of direction-dependent intensities of back-scattered light in ice. The scattering anisotropy was measured using a laser dust logger deployed in the SPICEcore borehole. The study follows previous observations of anisotropic light propagation in ice at the IceCube observatory. The measurements support results obtained from simulations of light diffusion by Chirkin and Rongen (2019). The authors conclude that scattering due to reflection and refraction on grain boundaries in a birefringent polycrystal play a major role for the anistropic modulation of light in ice.

The study is carefully carried out and well presented. It shows novel in-situ measurements of optical properties of ice. I believe it is a relevant contribution to our understanding of light propagation and scattering in ice. It may find application in current ice-core-analytical methods as well as in future developments.

I have some concerns about the general suitability of the method for obtaining a continuous fabric record. The intensity ratios can serve to determine the strength of anisotropy within a horizontal plane, so it works well for a girdle-type fabric. However, other types of arrangements of the c-axes can hardly be distinguished or even detected using the current design of the dust logger (e. g. a vertical single maximum, or other more complex distributions).

Specific comments

- p.1 l.7-8: See the last paragraph in general comments. I think the statement is too brave. Maybe it is just the term "fabric" which, in my understanding, includes a number of characteristics, which I am not convinced they are accessible for the dust logger.
- p.2 l.16-17: What crystal realization would strengthen the deflection effect?
- p.4 l.11-12: The corresponding accumulation site varies with depth, so the Titan Dome must refer to a particular depth in the ice core.
- p.6 l.10 and p.10 l.8: "craigite": The common terms are clathrate hydrates or air hydrates.

- p.9 Fig.7: If there is no anisotropy signature above 1100 m, how can you determine the anisotropy axis being 120 degrees above this depth?
- p.10 l.10-16: I also wonder what would be the effect of the grain shape and its preferred orientation. Also the scattering on grain boundary intersections (triple junctions) may add some contribution - possibly even an anisotropic one.

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