

## ***Interactive comment on “In-orbit results of the Coupled Dark State Magnetometer aboard the China Seismo-Electromagnetic Satellite” by Andreas Pollinger et al.***

### **Anonymous Referee #1**

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The paper "In-orbit results of the Coupled Dark State Magnetometer [CDSM] aboard the China Seismo-Electromagnetic Satellite", by Andreas Pollinger and others, presents the first performance results of a novel scalar magnetometer technology. It is a sequel to an earlier paper [Pollinger et al, 2018] which presented the same CDSM in its flight-ready state. The performance results presented are derived from a subset of roughly the first year's supply of data as delivered from the new China Seismo-Electromagnetic Satellite which launched in Feb, 2018. This study has taken careful looks at sources of inaccuracy, both expected and unknown. The main points of examination relate to effects of temperature on the CDSM, and on the effects of magnetic field alignment as it relates to the optical axis of the CDSM sensor.

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The examinations appear very thorough, finding systematic errors of comparable magnitude to other, older technologies. The new CDSM instrument technology may well find new uses on spacecraft, but performance testing of the types presented here is a necessary stage of development. I would thank the authors for placing these early results into the public domain.

I have only two discussion points to raise. One has to do with temperature measurement and control, the other with future expectations for the CDSM technology.

p 15, l 286 The authors refer here to trying to minimize current in a platinum temperature sensor. Is there a reference available that includes details of the temperature sensor and its error analysis? My read of Pollinger et al (2018) does not discuss this, but that paper does refer to temperature control loops using thermistors and bifilar heating coils. A search in that paper for the work "platinum" finds no occurrences. If not could a few details be included here: nominal temperature sensor resistance, power dissipation in platinum resistor, distance to CDSM cell, estimated magnetic contamination by the temperature sensor. Possibly a general discussion of the temperature monitoring and control regimen could be added. The statement regarding minimizing current also suggests that the temperature sense current is operating continuously. Given the three way time slicing of each second would it not have been possible to make temperature measurements during the first third of each second, and disabling the temperature sense current during the remainder of the second? What temperature measurement accuracy is required to achieve suitable values for control or compensation?

p 25, l 469 "For future missions a new sensor design was developed which reduces the sensitivity of the magnetic field measurement on the microwave oscillator frequency detuning."

This closing statement leaves the reader with several questions. What is the basis for such a redesign? What would be the benefit? Are the authors satisfied with the development progress of the CDSM to date? Given the now known inaccuracy profile for

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the present CDSM are large improvements likely to be possible? What are future plans for both performance testing of this existing sensor, or generally for future redesign considerations.

All further comments are with regard to minor English usage issues. Call me old-fashioned, but for me the word "data" is a plural word ["Daten" in German], and the correct English usage requires the plural verb. Most of the following are minor corrections for that usage, plus a few typographic errors.

p 3, l 67 "All available housekeeping data is within the nominal operational limits throughout the so far elapsed mission time."

This sentence is awkward. Perhaps better would be "All available housekeeping data fall within the nominal...." Also in Fig 3 and line 68 it might be better to use the expression "minimum optical power" rather than "minimal optical power" as in p 4, l 76.

p 4, l 72 "all data was made available" to "all data were made available"

l 78 "data is" to "data are"

p 5, l 110 "fight model" to "flight model" ???

l 112 "data is" to "data are"

p 11, l 202 "data with ... has been" to " data with ... have been"

l 211 "Data ... has been" to "Data ... have been"

p 13, l 227 "data ... was available" to "data ... were available"

p 15, l 286 "data was filtered" to "data were filtered"

p 20, l 355 "data ... was derived" to "data ... were derived"

p 22, l 399 "solid back lines" to "solid black lines" ???

p 23 l 427 "data has" to "data have"

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Interactive comment on Geosci. Instrum. Method. Data Syst. Discuss.,  
<https://doi.org/10.5194/gi-2019-35>, 2019.

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