

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Galina Chikunova

PhD Program: Engineering Systems

Title of Thesis: Coronal dimmings associated with coronal mass ejections: evolution, lifetime, and relation to the directivity

Supervisor: Associate Professor Tatiana Podladchikova

Name of the Reviewer:

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| I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict) | Date: 22-11-2023 |
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The purpose of this report is to obtain an independent review from the members of PhD defense Jury before the thesis defense. The members of PhD defense Jury are asked to submit signed copy of the report at least 30 days prior the thesis defense. The Reviewers are asked to bring a copy of the completed report to the thesis defense and to discuss the contents of each report with each other before the thesis defense.

If the reviewers have any queries about the thesis which they wish to raise in advance, please contact the Chair of the Jury.

Reviewer's Report

Reviewers report should contain the following items:

- Brief evaluation of the thesis quality and overall structure of the dissertation.
- The relevance of the topic of dissertation work to its actual content
- The relevance of the methods used in the dissertation
- The scientific significance of the results obtained and their compliance with the international level and current state of the art
- The relevance of the obtained results to applications (if applicable)
- The quality of publications

The summary of issues to be addressed before/during the thesis defense

- I find this thesis to be excellent. It nicely combines comprehensive analysis and refinement of existing research methods in the field, and also extends them in multiple ways.
- The work is accurately described.
- The methods employed are relevant.
- The results are quite significant, since they greatly extend our knowledge of the key “dimming” signature of a CME in the low corona, and thus uniquely help to anticipate its development in the heliosphere.
- The published papers are excellent, and the description of paper now in review is good,.

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Specific points the candidate may address, including typos/grammar. The thesis is very well prepared and has excellent English, with only a few minor points to consider.

p. 12. I don't think Solar requires capitalization

p. 20. Sunspots don't occur in "pairs", but groups, and often are solitary. Hoyt & Schatten didn't invent this morphology.

p. 37. Thermal instability doesn't explain the lack of a filament.

Sect. 2.3. Should cite the “implosion” conjecture (Hudson 2000) for initiation, since this is closely related to the reconnection physics

Fig. 3.3. caption should include date

Fig. 3.4. caption needs citation of source

p. 70. Need to give a comparison date for the Python switch

p. 73. Need to explain HEEQ

Eq. 4.5. Needs punctuation; please check other math in this regard

p. 84. The Dissauer citation has a misplaced bracket. Please check other citations for other cases where the name should be parenthetical

Eq. 4.12, should define t_{dur}

Fig. 5.2. This is the first example of (k,d) listing in the figure legend. The caption should therefore repeat the definition and note that subsequent such figures are coming.

Fig. 5.5. What is the one-to-one relation?

p. 113. "[60..." garbled

Sect. 5.4.2. The comparison between on-disk and off-disk dimmings is not motivated very well: these in principle are different projections of something that is not geometrically simple.

p. 125. Isn't the Attrill idea a non-starter? Interchange reconnection does not really diminish the open flux, does it? In addition this summary does not mention loop retraction, for which there is literature e.g. by Wang & Sheeley, Simnett and others.

p. 167. The Aschwanden height estimation for hard X-rays is probably wrong. The only direct height observation is that of Martinez Oliveros (2012ApJ...753L..26M) and is quite inconsistent.

Figure 7-11. GOES does not observe 25 keV. The figure is showing HXR, not SXR, presumably from STIX?

p. 177. confusion of SXR and HXR

Figure 7-13. Is the croissant really plausible at the base of the corona? The footpoint regions shown don't seem to correspond to anything in the direct EUV images. Does this discrepancy affect the conclusions?

A general comment. The very long recovery times, thanks to this work, are long compared with even LDE flare development. The candidate might wish to comment on the energy flow in the standard CSHKP picture, which seems to be quite inconsistent with the implied behavior of the open flux the dimming shows. Are these observations consistent with the interpretation reconnection as an energy source in this late phase?

Provisional Recommendation

Yes

I recommend that the candidate should defend the thesis by means of a formal thesis defense

I recommend that the candidate should defend the thesis by means of a formal thesis defense only after appropriate changes would be introduced in candidate's thesis according to the recommendations of the present report

The thesis is not acceptable and I recommend that the candidate be exempt from the formal thesis defense