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Supplementary information

No pulsed radio emission during a bursting phase of a Galactic magnetar

In the format provided by the authors and unedited

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Peer Review File

Manuscript Title: No pulsed radio emission during a bursting phase of a Galactic magnetar

Reviewer Comments & Author Rebuttals

Reviewer Reports on the Initial Version:

Referee #2 (Remarks to the Author):

This paper reports on a targeted observing campaign of the FAST telescope observing SGRJ 1935+2154 during an active phase. During this phase SGRJ 1935+2154 appears to have emitted an FRB with two peaks, FRB200428, though FAST appears not to have observed this FRB as it fell between the observing windows of the telescope.

Given that no other FRB was observed by FAST during this observing campaign, the authors conclude that FRB-SGR burst associations are rare and only under extreme conditions would they occur. However, given the observing window of FAST was only 8 hours spread out over 4 observing periods unevenly spread over an almost two week window, I do not see enough evidence to claim any likelihoods of the burst associations. It is entirely possible that the associations were just missed due to the timing of the observations or due to being outside of the observing band, and without a physical mechanism to explain why these associations should be rare, I would not rush to that conclusion.

The observing windows are not regularly spaced, nor are they each the same length of time, which limits the conclusions to be made.

The authors further explain that in their third observing window, they observe 29 SGR bursts with no FRBs associated, which they find puzzling. Given the observing band of FAST, one cannot truly rule out an FRB during that time, but only one within their observing band. This is certainly possible, even if the authors claim it is unlikely. A coordinated campaign with matched observing windows or rapid communication between the telescopes involved might help to settle such questions in the future.

The claim in equation 2 in the methods section (below line 312) neglects to account for the fact that there may be FRBs emitted but outside of the frequency band observed by FAST. This bound is certainly a very rough estimate and should be stated as such.

Although FAST did not observe the FRB observed by STARE2 and CHIME, this work nevertheless represents an important part of the complete story, as it illustrates how relatively rare such a burst is as well as the likelihood for future searches. While there are several possible physical mechanism explain FRB emission from magnetars, any compelling candidate will need to explain all of the observations related to this event - both the very bright burst and the absence of other bursts commensurate with the 29 SGR bursts observed by FAST.

The article is well written, with minor grammatical errors in places but it is clear and appropriate throughout.

Author Rebuttals to Initial Comments:

Note: Reviewer comments in blue

We thank the referee for carefully reading the paper and for helpful suggestions. We have revised the paper to fully address them.

[This paper reports on a targeted observing campaign of the FAST telescope observing SGRJ 1935+2154 during an active phase. During this phase SGRJ 1935+2154 appears to have emitted an FRB with two peaks, FRB200428, though FAST appears not to have observed this FRB as it fell between the observing windows of the telescope.

Given that no other FRB was observed by FAST during this observing campaign, the authors conclude that FRB-SGR burst associations are rare and only under extreme conditions would they occur. However, given the observing window of FAST was only 8 hours spread out over 4 observing periods unevenly spread over an almost two week window,
I do not see enough evidence to claim any likelihoods of the burst associations. It is entirely possible that the associations were just missed due to the timing of the observations or due to being outside of the observing band, and without a physical mechanism to explain why these associations should be rare, I would not rush to that conclusion.]

Re: Indeed the observing window of FAST is limited and uneven. However, since we are investigating FRB-SGR associations, the relevant epochs are only those when SGR bursts are detected. In the majority of the epochs in the time span of our observational campaign, there were no bursts detected from the SGR source. In one time window there were 29 bursts detected by Fermi GBM. The effective duty cycle of our observational window is actually not too small. In the Methods, we added some information about other X-ray bursts detected by other high-energy missions. Altogether, there were about 300 bursts detected during the time span of our observational campaign. Since we caught at least 29 of them, our duty cycle is above 10%.

[The observing windows are not regularly spaced, nor are they each the same length of time, which limits the conclusions to be made.]

Re: We agree and have mentioned the caveat in the second paragraph.

[The authors further explain that in their third observing window, they observe 29 SGR bursts with no FRBs associated, which they find puzzling. Given the observing band of FAST, one cannot truly rule out an FRB during that time, but only one within their observing band. This is certainly possible, even if the authors claim it is unlikely. A coordinated campaign with matched observing windows or rapid communication between the telescopes involved might help to settle such questions in the future.]

Re: Exactly. We only claimed that there is no detection within the FAST band during those 29 SGR bursts. We are aware of the possibility that putative FRB-like events are outside the FAST band, and have calculated the required parameter space for such a scenario in the original version. We find that the requirements are quite stringent. We agree that a coordinated campaign with matched observing windows or rapid communication between the telescopes involved is important to settle the questions in the future. On the other hand, SGR bursts occur randomly in time during the active phase, and FAST is limited to epochs when the source is observable in the field of view. It is hard to catch bursts in the fly. Indeed, the epoch when the 29 bursts occurred was triggered through a ToO-like observing mode, i.e. FAST was pointed to the source after getting the alert that the SGR source became very active.

[The claim in equation 2 in the methods section (below line 312) neglects to account for the fact that there may be FRBs emitted but outside of the frequency band observed by FAST. This bound is certainly a very rough estimate and should be stated as such.]

Re: We have clarified that that equation is the fraction the non-detection of FRBs within the FAST band. Indeed it is possible the bursts are outside the FAST band. This was the second possibility we have discussed in the paper.

[Although FAST did not observe the FRB observed by STARE2 and CHIME, this work nevertheless represents an important part of the complete story, as it illustrates how relatively rare such a burst is as well as the likelihood for future searches. While there are several possible physical mechanism explain FRB emission from magnetars, any compelling candidate will need to explain all of the observations related to this event - both the very bright burst and the absence of other bursts commensurate with the 29 SGR bursts observed by FAST.

The article is well written, with minor grammatical errors in places but it is clear and appropriate throughout.]

Re: Thank you for the comment on the importance of this paper and the support for publication in Nature. We have further revised the paper to correct some grammatical errors.