FASR Science Use Case Submission Form

The Frequency Agile Solar Radiotelescope (FASR) is a next-generation, solar-dedicated radio observatory concept endorsed by the 2024–2033 Solar and Space Physics Decadal Survey. See https://fasrtelescope.org/#about-fasr for more details. This purpose of this form is to gather science use cases from the community, and to broaden FASR's science objectives and refine its technical design.

Ultimately, we would like to translate the use cases to detailed technical requirements and observing modes for FASR. However, **submissions of science use cases at all stages are welcome**! For those who already know the technical specifications they will need, please continue to the extended "technical requirements" section on the second page. However, you are welcome to skip it if you do not feel you have the information on hand. The FASR team and Science Working Groups are happy to work with you to further develop the technical requirements. See https://fasrtelescope.org/contact/ for contact information.

Note that to minimize duplications, all the submitted science use cases will be made public. The previously submitted science use cases are accessible at this link:

* Indicates required question

1. Email *

2. **Name** *

3. **Affiliation** *

4. **Names and affiliations of collaborators (if any)**

_____

_____

_____

_____

_____

5. **Science Use Case Title** *

_____

_____

_____

_____

6. **Science Goal(s)** *

Briefly summarize the key science goal(s) for this science case. A few sentences will be sufficient.

_____

_____

_____

_____

7. **Science Working Group(s) of Interest** *

Which FASR Science Working Group(s) would you like this use case to be considered under? (Select one or more)

Check all that apply.

- [ ] SWG1 – Magnetic Reconnection & Particle Acceleration
- [ ] SWG2 – Coronal Magnetography
- [ ] SWG3 – Coronal Heating & Solar Wind Acceleration
- [ ] SWG4 – Drivers of Space Weather
- [ ] Other topic

8. **Scientific Rationale:** Importance *

Provide a brief discussion on the scientific importance of this science use case.

9. **Scientific Rationale:** Uniqueness to FASR Capabilities

Is this science case uniquely addressed by FASR? Why can't other facilities address this science and achieve the same goal? If there is overlap with other observatories' capabilities, please comment.

10. **Scientific Rationale:** Synergies

Describe potential synergies/complementarities between this FASR science case and those from current/future/planned facilities at all wavelengths (e.g., DKIST, MUSE, FIERCE, COSMO, ngGONG, etc.).

_____

_____

_____

_____

_____

11. **Observational Targets:** Target Type (select all that apply) *

Check all that apply.

- ☐ Synoptic
- ☐ Quiet Sun
- ☐ Active Regions
- ☐ Solar Flares
- ☐ CMEs
- ☐ Middle Corona
- ☐ Other: _____

12. **Observational Targets:** Event-Driven or Long-Term Monitoring? *

Mark only one oval.

- ◯ Event-driven
- ◯ Synoptic / monitoring
- ◯ Both

13. **Observational Targets:** Description *

Provide a brief description of the target [e.g., gyrosynchrotron radiation from coronal mass ejections in the low corona (<1.5 solar radii)]

_____

_____

_____

_____

_____

14. **Observational Targets:** Number of Targets *

Estimated number of targets to image/track in any single integration. For example, if you would like to observe up to 5 active regions in a single 1-min integration, you may put in " <5" or "a few."

_____

15. **Observational Targets:** Spatial Scale of Each Target.   *

For example, if your target is active regions, something like "A few arcminutes" would be the best description.

Mark only one oval.

◯ Sub-arcsecond

◯ A few arcseconds

◯ Tens of arcseconds

◯ A few arcminutes

◯ Full Sun / global

◯ Other: _____

16. **Observational Targets:** Spatial Distribution of All Targets *

If there is more than one target for each observational run, please provide an estimate of the total spatial distribution of all these targets. For example, if you target multiple bright points distributed over an active region. Each of your target (bright point) has a spatial scale of a few arcseconds, but their total spatial distribution is over the active region scale. In this case, you may write "a few arcminutes." This eventually will help us define the field of view.

_____

_____

_____

_____

_____

17. **Observational Targets:** Shortest Temporal Scale of Interest. This input would *
eventually define the required time resolution for this use case.

Mark only one oval.

◯ Milliseconds

◯ Seconds

◯ Minutes

◯ Hours

◯ Long-term / synoptic

◯ Other: _____

18. **Observational Targets:** Frequency Range *

Consider this as the frequency range needed to cover the spectral characteristics of the observational target(s) in order to fulfill this science goal. For example, if your target's spectrum is continuous across a very wide frequency range, but your goal only requires analyzing the target's spectrum in 1-5 GHz, writing "1-5 GHz" is more helpful than "as wide as possible." The nominal frequency range of FASR is 0.2-20 GHz. However, if your target goes beyond this nominal range, feel free to state that. It can be adjusted based on technical feasibility and trade-offs.

_____

_____

_____

_____

19. **Polarization Product Required (choose all that apply) ***

Check all that apply.

☐ Stokes I
☐ Stokes Q
☐ Stokes U
☐ Stokes V
☐ Not sure

20. If you have additional comments that pertain to the items on this page, enter that here.

_____

_____

_____

_____

21. **Providing Additional Target Information and Technical Requirements** *

    The following section contains <u>optional</u> questions that are meant to gather additional information of the observational targets and technical requirements, such as brightness, polarization, and temporal / imaging / spectral characteristics. Please feel free to provide anything you can think of or submit the form as is. The instrument team will reach out to you and develop these requirements with you.

    Mark only one oval.

    ◯ Yes, I would like to see them and give it a try!

    ◯ No, I'd like to submit it as is and develop the detailed requirements at a later time.

Additional Target Information and Technical Requirements

This section is to provide additional information of the observational targets and technical requirements. All the questions are optional. Please feel free to provide anything you can think of. The instrument team can work with you to develop these requirements.

22. **Observational Target(s):** Peak Brightness (Kelvin or sfu/beam)

    _____

23. **Observational Target(s):** RMS Brightness (Kelvin or sfu/beam)

    _____

24. **Observational Target(s):** Circular Polarization Degree (V/I %)

    _____

25. **Observational Target(s):** Linear Polarization Degree (Q/I or U/I %)

    _____

26. **Observational Target(s):** Additional Information
Provide any assumptions, trade-offs, or uncertainties related to the observational targets.

27. **Spectral-Temporal Requirements: Central Frequency (GHz)**
Estimated central frequency of the target. A range is fine.

28. **Spectral-Temporal Requirements:** instantaneous Bandwidth (GHz/pol)
Instantaneous bandwidth to cover the essential spectrum of the target

29. **Spectral-Temporal Requirements:** Spectral Resolution (MHz, or % of the bandwidth)
Spectral resolution needed to resolve key spectral features of the target

30. **Spectral-Temporal Requirements:** Temporal Resolution (in seconds)
Temporal resolution required to resolve the temporal evolution of the target

31. **Spectral-Temporal Requirements:** Additional Information

Provide any assumptions, trade-offs, or uncertainties that defines the input above.

_____

_____

_____

_____

_____

32. **Imaging Requirements:** Largest Angular Scale Required (arcsec)

Largest angular scale needed to reveal the full context of the source. This will drive considerations of the shortest baseline needed for the array configuration.

_____

33. **Imaging Requirements:** Angular Resolution Required (arcsec)

Angular resolution required to resolve key spatial features of the target (single value or range)

_____

34. **Imaging Requirements:** Pixel Resolution (arcsec)

For achieving Nyquist sampling, the <u>minimum</u> requirement of the pixel resolution is 1/2 of the required angular resolution. However, for certain cases, denser pixel sampling is required.

_____

35. **Imaging Requirements:** Image Size (arcmin x arcmin)

Image size you wish to have to include both the target and the background context

_____

36. **Imaging Requirements:** Number of Image Channels

Number of image channels needed. This can be estimated together with the frequency range of the target and the required spectral resolution.

_____

37. **Imaging Requirements:** Total Output Bandwidth (minimum and maximum frequency - GHz)

Total bandwidth of the final output spectral image cube, e.g., 1-10 GHz

_____

38. **Imaging Requirements:** Channel Width (MHz)

Width of each frequency channel of the spectral image cube. This is usually considered together with the spectral resolution required for the target.

_____

39. **Imaging Requirements:** Required RMS per Channel (Kelvin or sfu/beam)

This is related to the required sensitivity of the target with a given channel width and integration time. Often one also needs to consider the contribution from a background source, such as the quiet Sun disk or an active region.

_____

40. **Imaging Requirements:** Image Dynamic Range

Image dynamic range is defined as the ratio of the brightest to the faintest sources needed to be observed in the same image, e.g., 1000:1. (If polarization products required define for each.)

_____

41. **Imaging Requirements:** Polarization Accuracy (%)

For example, 5% for V/I (below which the science cannot be achieved)

_____

42. **Imaging Requirements:** Zero Spacing / Total Power Needed?

Typical radio interferometers only measure correlated visibilities between pairs of antennas, and thus do not have "zero spacing" or total power flux included. Provisions are needed (but certainly possible) in order to include zero spacing measurements. If your science requires this, answer yes.

Mark only one oval.

◯ Yes

◯ No

◯ Not sure

43. **Imaging Requirements:** Required Flux Density Scale Accuracy

Mark only one oval.

◯ 1-3%

◯ 5%

◯ 10%

◯ 20-50%

44. **Imaging Requirements:** Maximum Acceptable Latency (seconds)

A latency is usually required for space weather applications. If your science does not require that, just say N/A.

_____

_____

_____

_____

_____

45. **Imaging Requirements:** Additional Discussion

Provide a brief discussion describing how these values are obtained/estimated, any trade-offs, interrelationships between the values, or anything else that is not captured in the above table.

_____

_____

_____

_____

46. **Other Performance or Functional Requirements**

If there are any additional performance or functional requirements not captured above, describe them here. For example, beamforming array mode, phased array, etc.

_____

_____

_____

_____

Google Forms