

Using 360-degree Cameras on Stratospheric Balloon Flights

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Abstract:

The growing availability and increasing functionality of 360-degree video cameras, AKA omnidirectional cameras, is expanding photography options for many applications, including for stratospheric ballooning. Our ballooning team flew Garmin VIRB 360 cameras during eclipse flights in 2017. More recently, we have gained experience flying Insta360 ONE RS, ONE X2, and X3 cameras as well. This poster/demonstration will discuss our experiences with these 360 cameras and give recommendations for using them on stratospheric ballooning missions. These cameras are more prone to overheating than to getting too cold, so we fly them fully-exposed, mounted on “invisible” selfie sticks. Care must be taken not to run out of memory during a flight. To extend run time, we plug such cameras into an external battery pack mounted in a nearby insulated payload box. Somewhat unexpectedly, it does make a difference which direction you point which lens, even if the camera captures 360° views. We will also discuss the software and hardware used for viewing footage, ranging from phone screens to computer screens to using VR goggles. We will also discuss the utility of certain camera features, such as horizon lock, image stabilization, and GPS-on-screen, for stratospheric ballooning photography applications.

Setting up a 360-degree camera on a payload

To set up a 360 camera for a balloon flight, you need to specify the resolution you require and make sure it's on the right video format. Since 360 cameras generate a lot of heat, they don't run the risk of getting too cold and can be flown fully exposed. Setting it up like this (Image 1) means that the 360 camera is outside of the payload and the selfie stick is strapped to the payload. The software can erase the selfie stick in the video.



Image 1, Insta360 one RS attached to payload

Processing a 360-degree video

The Insta360 camera saves its video files in .insv format which can only be processed by the Insta360 studio app, Premiere Pro, or Final Cut Pro. To use Premiere Pro or Final Cut Pro on a .insv file, you need to install a plugin from the Insta360 website; the website offers information on how to install the plugin. Even if it has limited editing options compared to Premier Pro or Final Cut Pro, the Insta360 studio app works great for basic editing. It is necessary to go through one of these editing software packages to get a proper 360 mp4 file. Otherwise, if you try to directly convert it to an mp4, the result will contain 2 bubble viewpoints, one for each lens on the camera (Image 2). This cannot be viewed by a VR headset as a 360 video. Image 3 shows an example of using Insta360 software to view a 360 video.

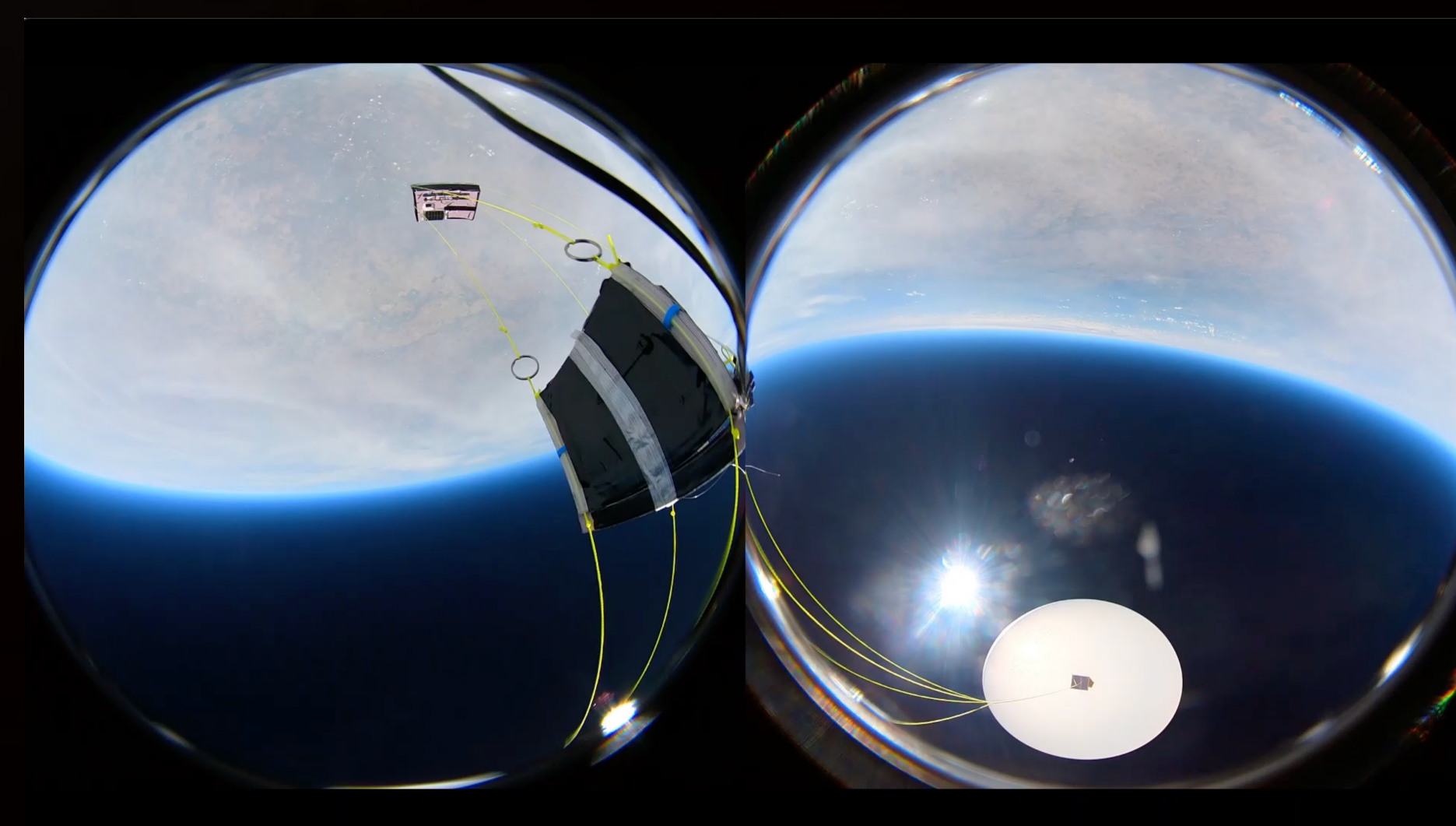


Image 2, screenshot of the 360 video directly converted to an mp4 file format

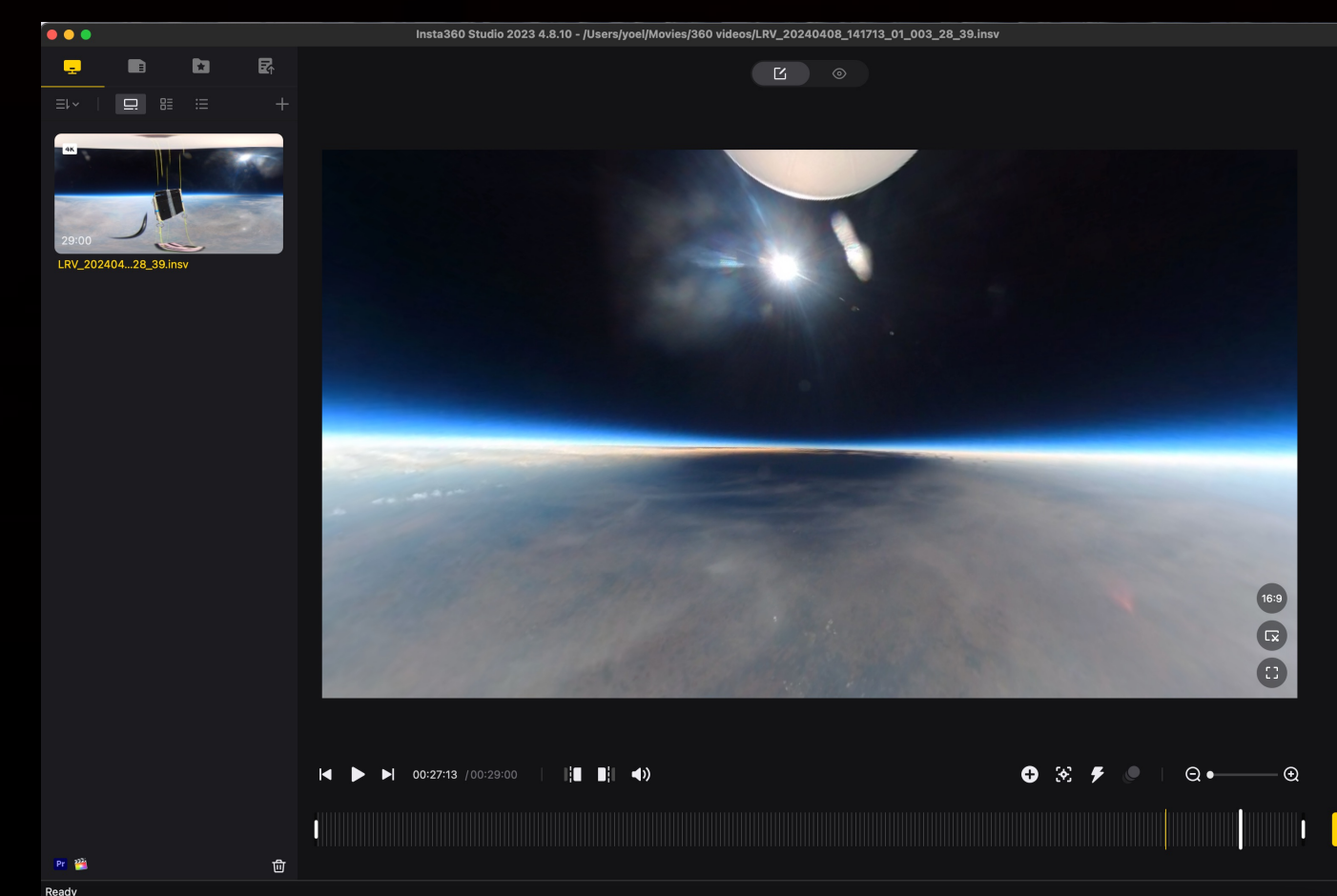


Image 3, example of what using the Insta360 studio looks like

You can also use the project tab (Image 4) in the software to create one long video from the individual videos recorded by the Insta360 camera, add subtitles, add audio, and add transitions. The project tab comes with a major limitation; you can't export the video as a 360 video through the project tab, only a flat video format.

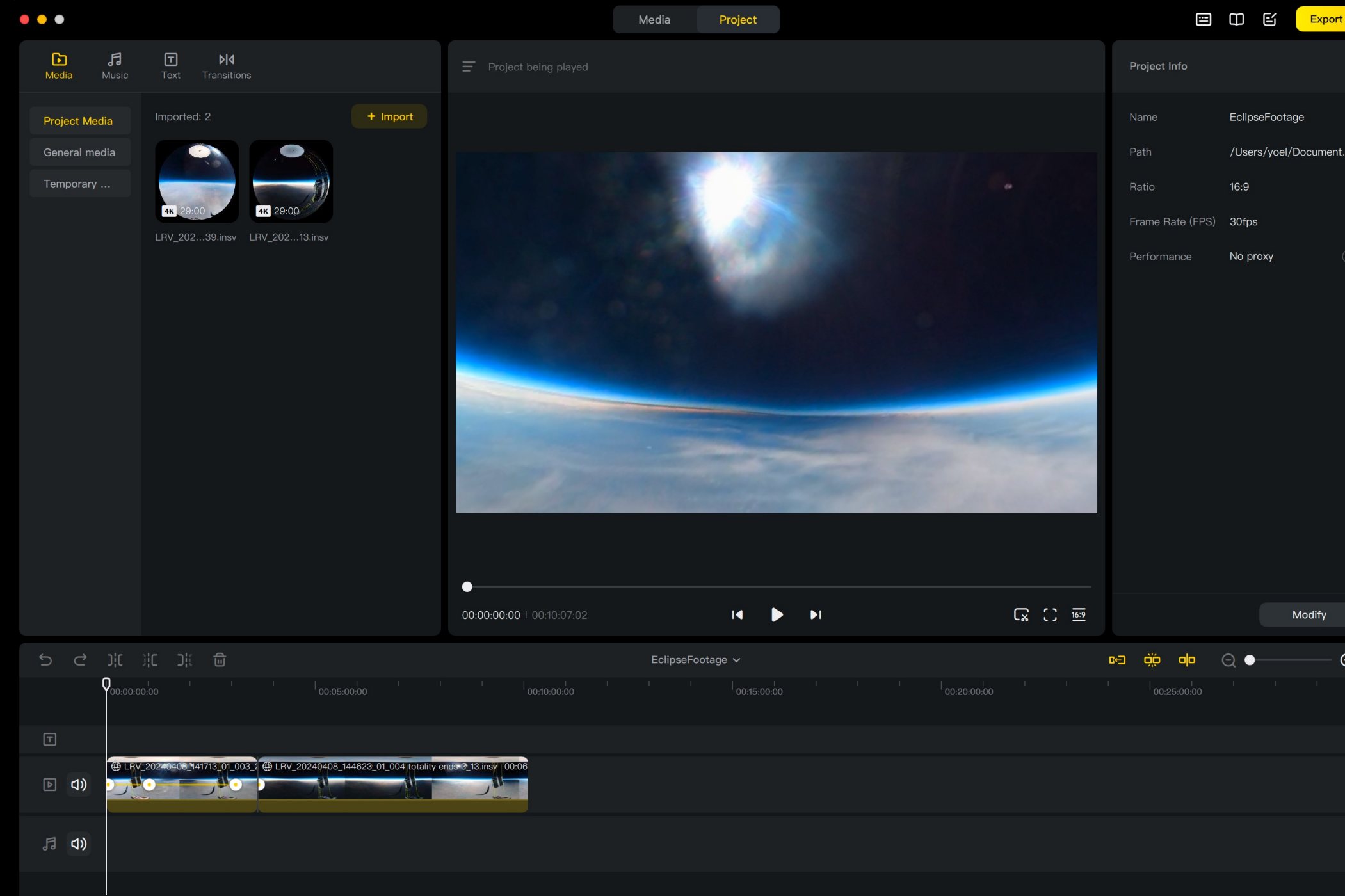


Image 4, using the project tab in Insta360 studio

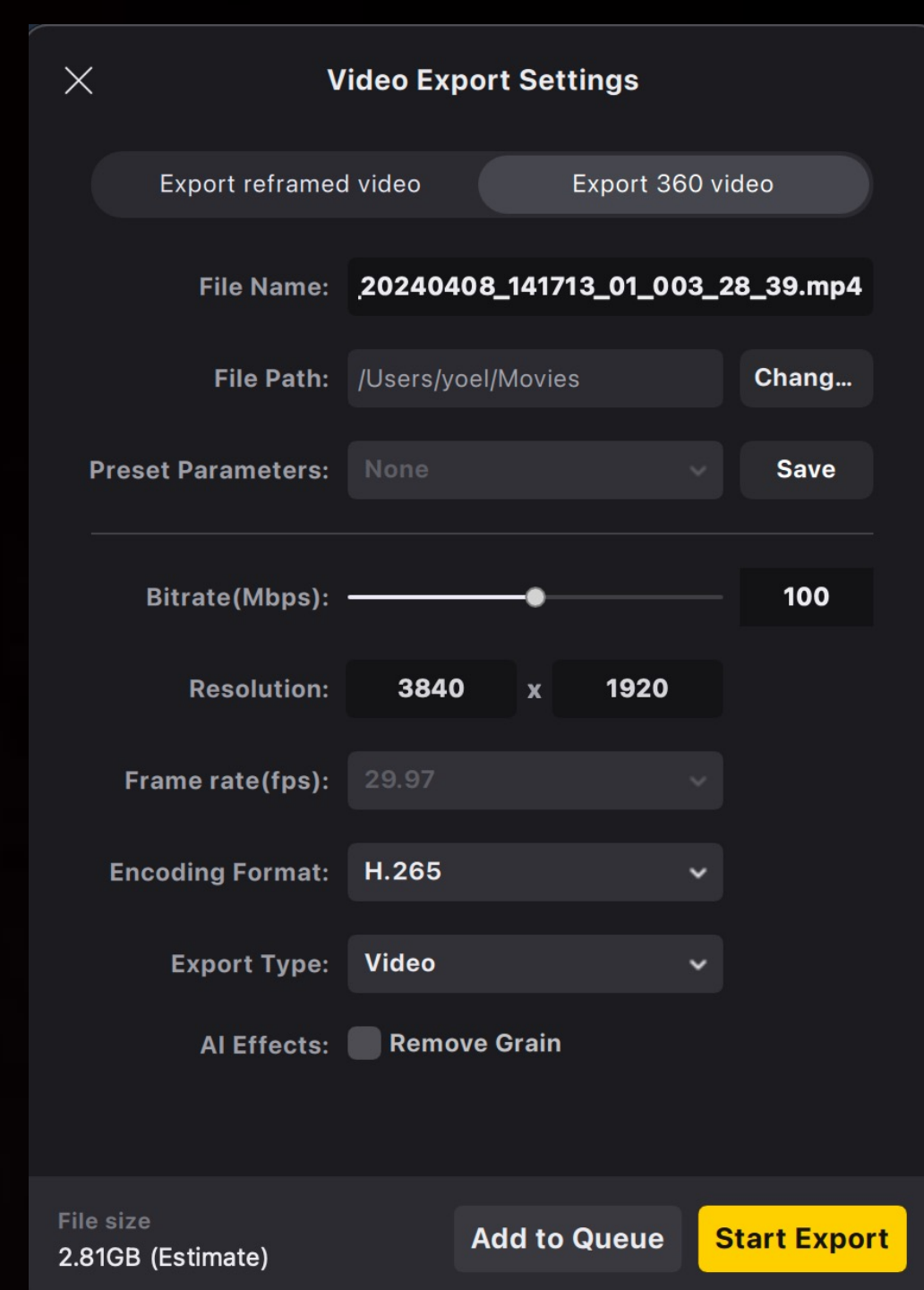


Image 5, recommended settings when exporting

When exporting 360 videos, click the export 360 video button on the top right, set the bitrate to 100 (anything above this value has diminishing returns and wastes space), set to a desired resolution, set encoding format (H.265 is recommended for slightly higher quality, but H.264 also works well), then start the export (Image 5).

Presenting 360 videos on a Meta Quest VR headset

A Meta Quest VR headset (Image 6) is a stand-alone VR headset that doesn't need to be plugged into a computer to work. Since it's a VR headset, we can view the 360° mp4 file that was exported from the editing software.



Image 6, Meta Quest 2 VR headset

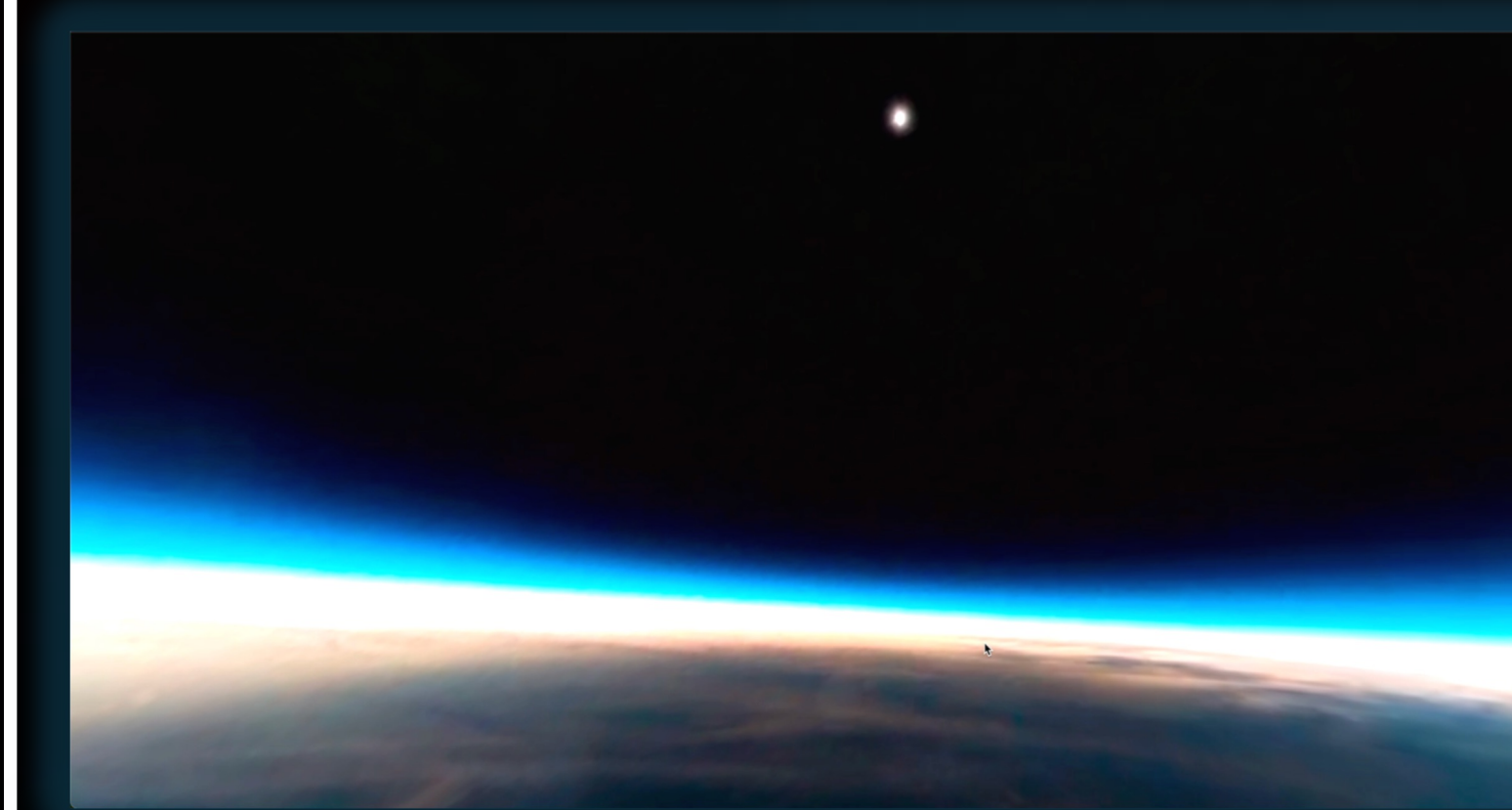


Image 7, an image of the totality viewed through DEO on a meta quest 2

The Meta Quest comes with a built-in video player called Meta Quest TV. This application is more than enough to view 360 videos. There are better applications that can offer a slightly more immersive experience. One free application is DEO (Image 7),

a streaming app that allows you to view videos with significantly more control and flexibility than the built-in TV app.

Once the files have been transferred, you can open up the 360 mp4 video in your preferred video player. If you are using the TV app, make sure the playing format is “360 2D”. Otherwise, you'll still be viewing a flat video. If you are using DEO, make sure that the playing format is “360 Lat/Long” and “mono” format (Image 8).

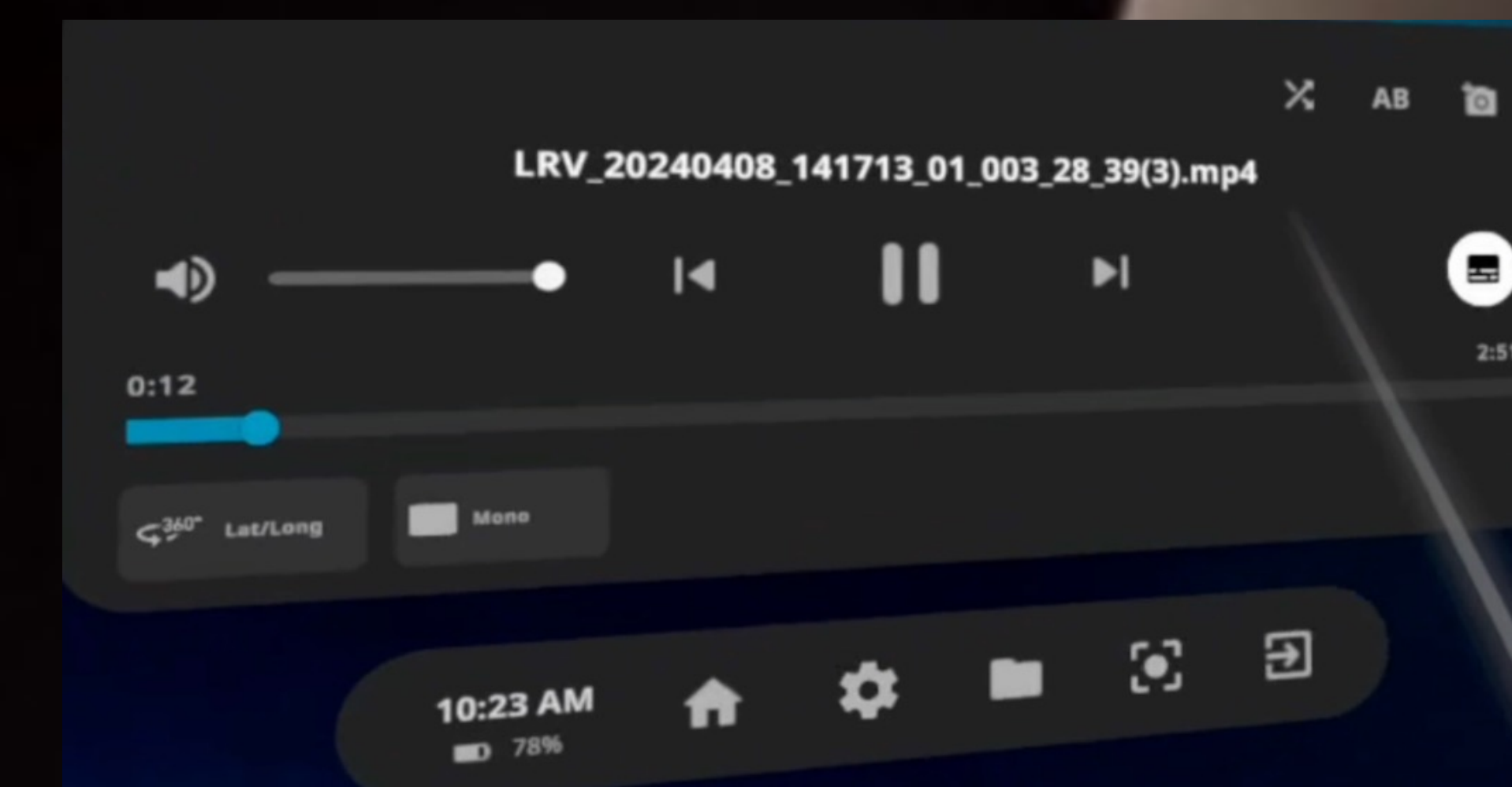


Image 8, viewing settings for DEO

Acknowledgment

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References

1. <https://www.insta360.com/>
2. <https://www.meta.com/quest/>
3. Background Image, Noé Bazán