

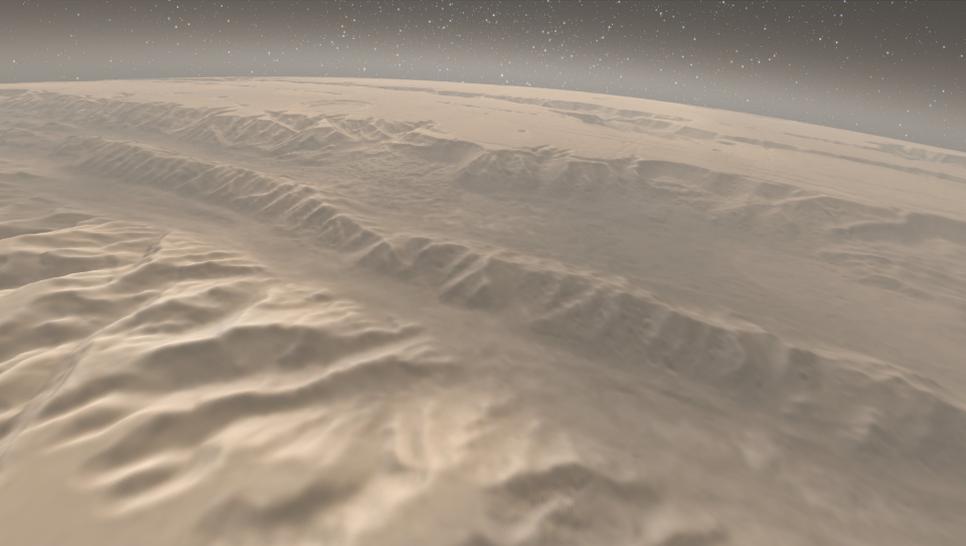
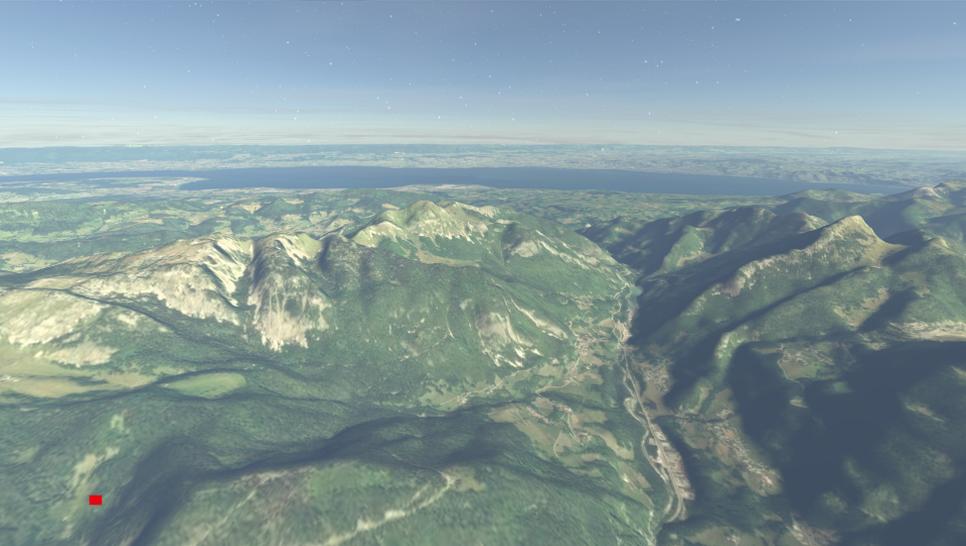
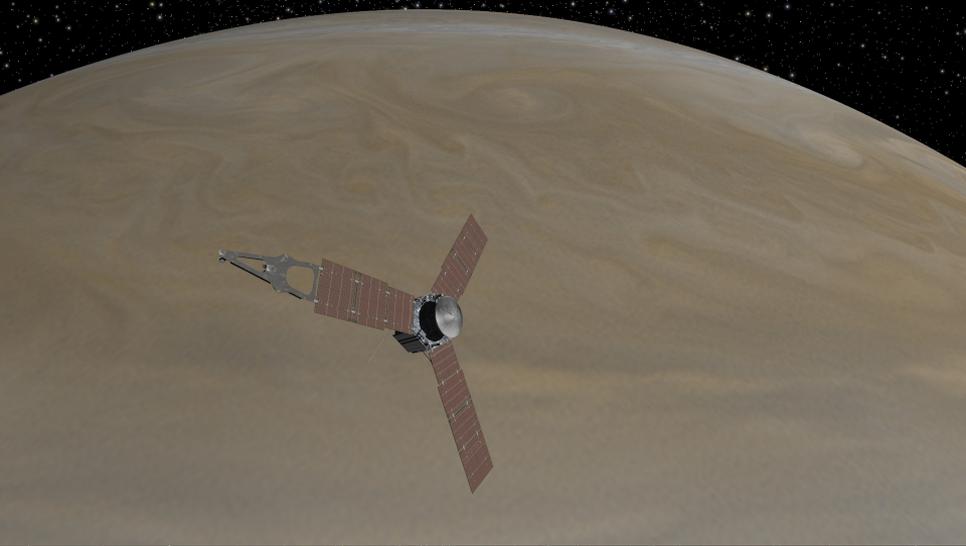
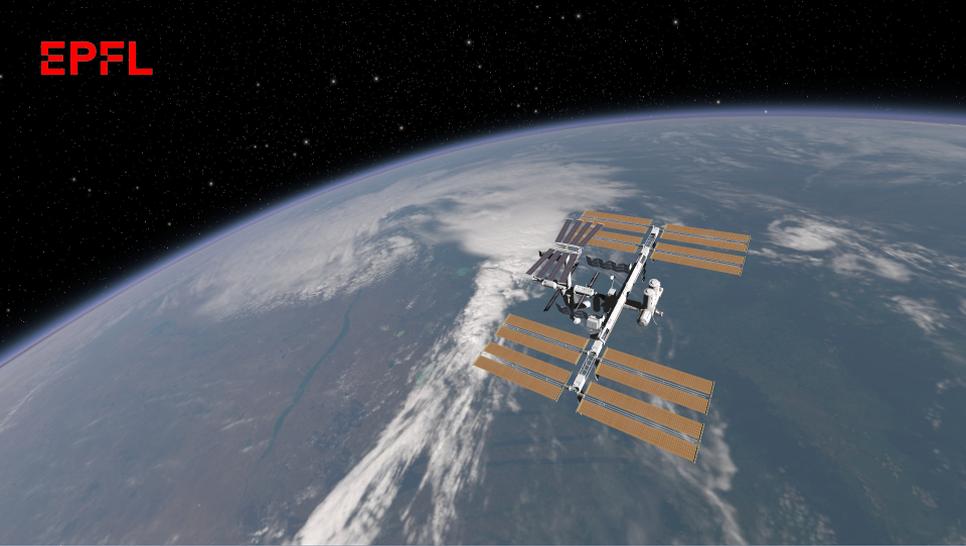


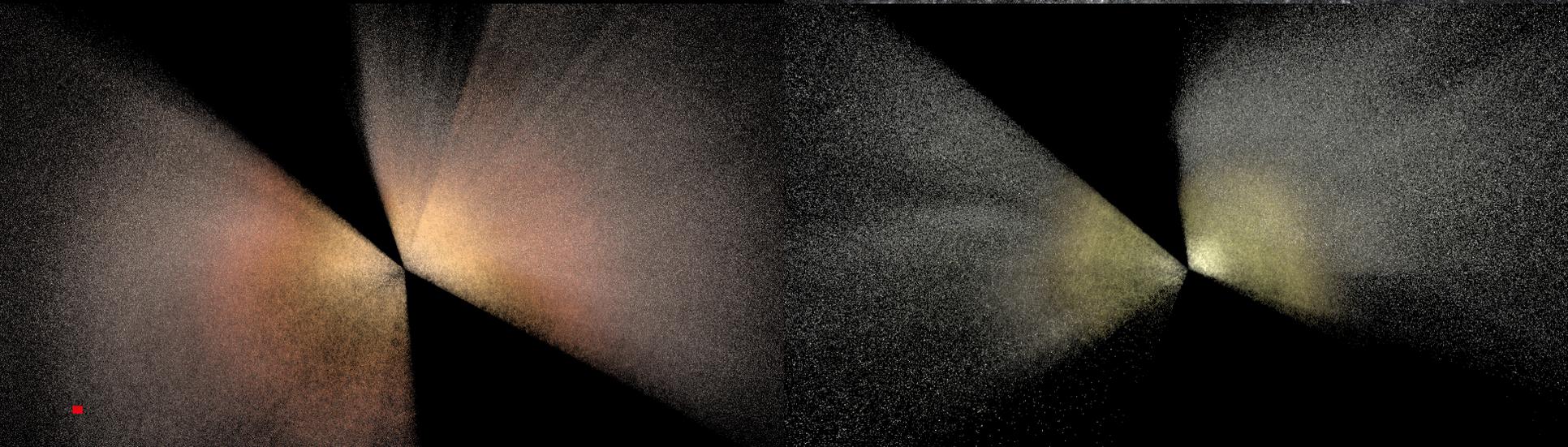
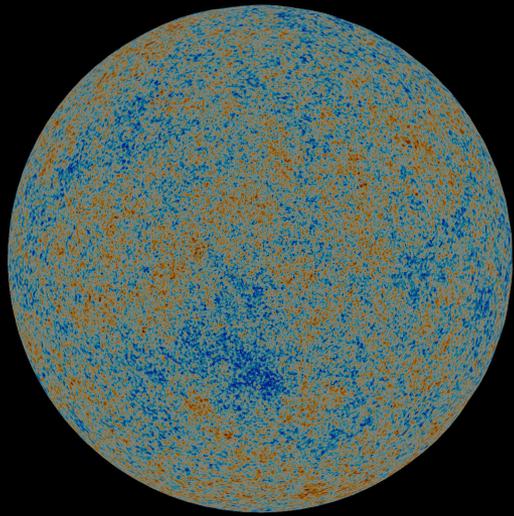
VIRUP : Project Update

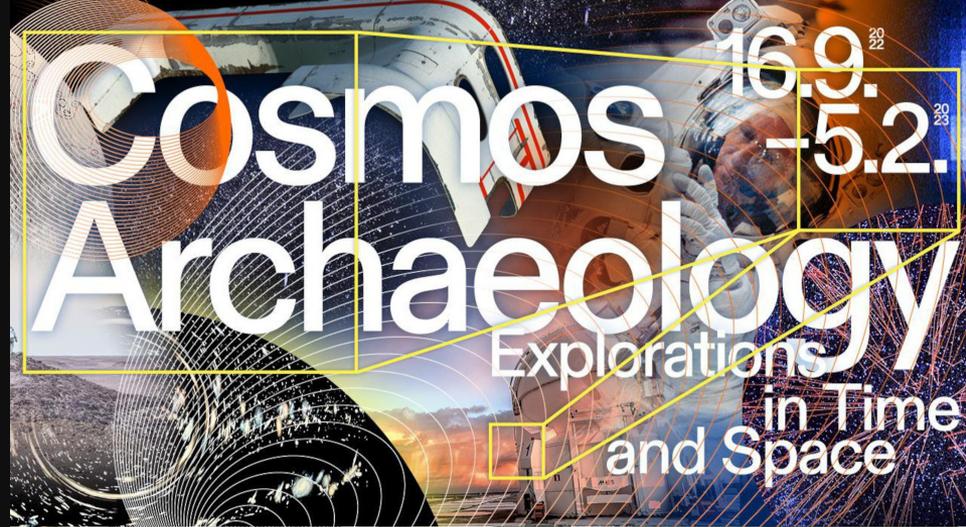
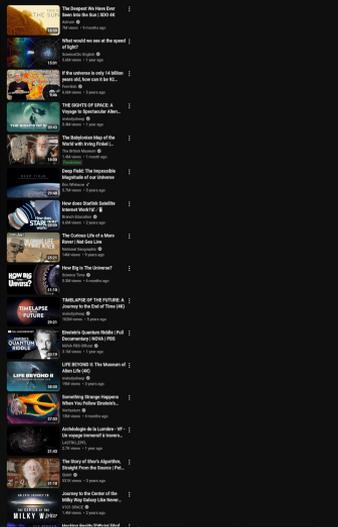
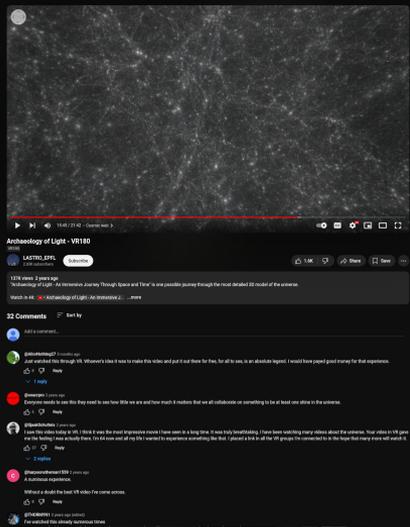
Florian CABOT

OUTLINE

- Quick refresh about what VIRUP is
- Chatbot status
- Windows build system rewrite
- Vulkan port status
- Future







DEVELOPMENT PLAN

- Focus on putting VIRUP in the hands of as many people as possible
- Distribute data in a more accessible way to propose more datasets
- Allow scientists to publish their data themselves or use the tool for their own outreach communication
- LLM-based AI and voice recognition for automatic guidance through the data
- Support even more hardware (by migrating from OpenGL 4.5 to Vulkan first)

CHATBOT STATUS

CHATBOT STATUS

- We are collaborating with Zhejiang Lab in Hangzhou/China with their OneAstronomy LLM (other OpenAI-compatible APIs can also be used, such as ChatGPT)
- Whisper runs locally for voice recognition
- We can query either OpenAI TTS or QwentTTS for text-to-speech voice generation
- It acts as an agent which controls VIRUP, and can answer questions about astrophysics

CHATBOT STATUS

- The code is now ready for publication
- Most of the efforts lately were done on VIRUP's build system to compile whisper.cpp properly for every platform
- Windows gave me the most headaches, as usual, and is still not confirmed to fully work (no chatbot-specific errors anymore but the chatbot integration introduced crashes when loading certain seemingly unrelated .dlls) → still under investigation

WINDOWS BUILD SYSTEM REWRITE

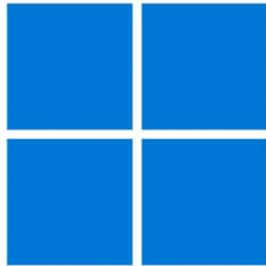
WINDOWS BUILD SYSTEM REWRITE

Why Windows native builds are bad :

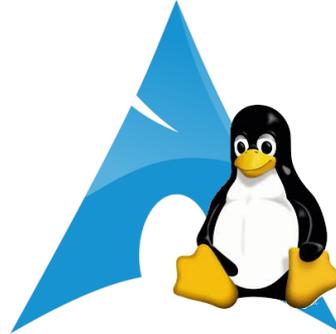
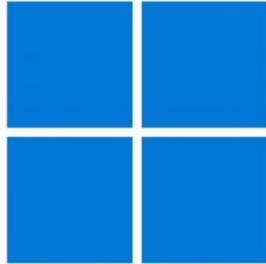
- No package manager on Windows (WinGet is not a proper package manager) → you have to at least compile most of your dependencies (if not manually build them, and CMake find_package doesn't work well on Windows)
- Windows Server is bloat → you don't want to run it yourself so you're dependent on third-party server hosts
- No docker
- Most services offering access to Windows CI/CD have slow hardware+strong limits - especially since VIRUP is hosted on Gitlab (but maybe Github Actions runners are bad as well)

All of those points make it a no-go to use Windows native builds for large projects.

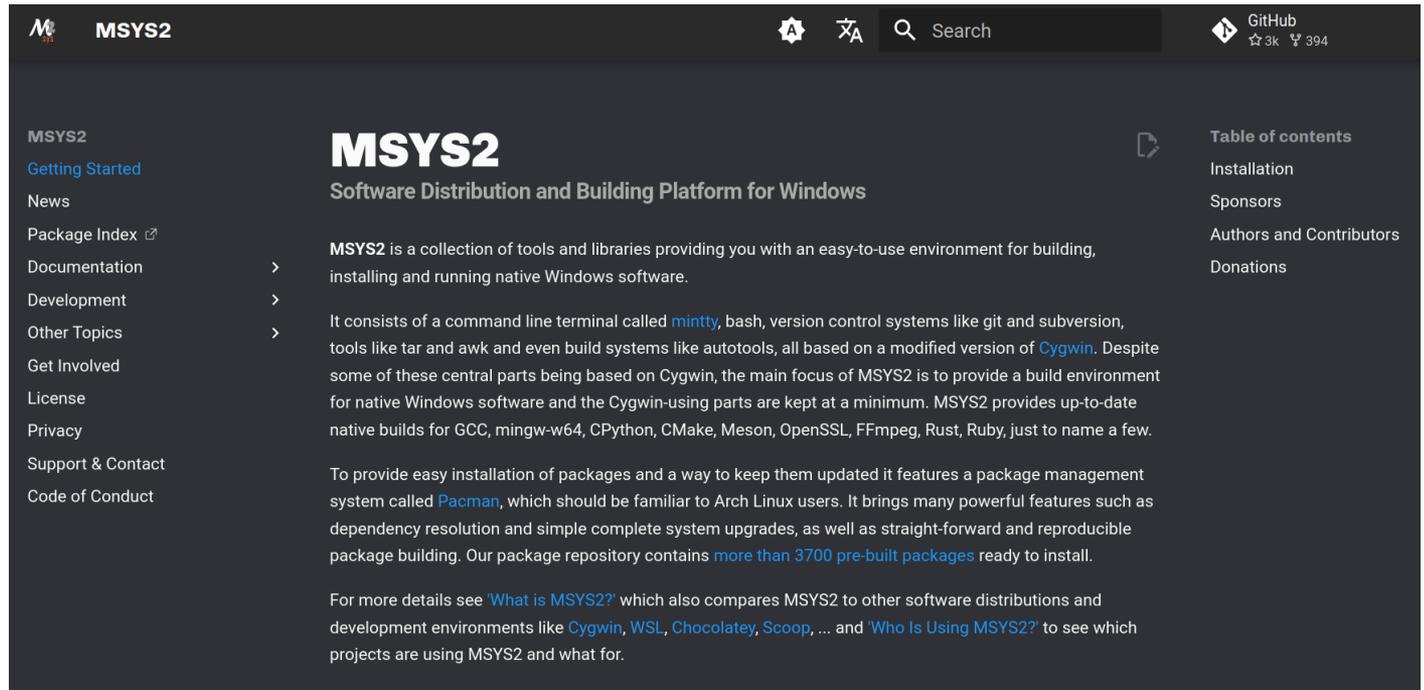
WINDOWS BUILD SYSTEM REWRITE



WINDOWS BUILD SYSTEM REWRITE



WINDOWS BUILD SYSTEM REWRITE

A screenshot of the MSYS2 website. The page has a dark theme. At the top left is the MSYS2 logo. To its right is the text 'MSYS2'. Further right are icons for a gear, a terminal, and a search icon, followed by a search bar containing the text 'Search'. On the far right is a GitHub logo with the text 'GitHub', '3K', and '394'. Below the header is a navigation menu on the left with items: 'MSYS2', 'Getting Started', 'News', 'Package Index', 'Documentation', 'Development', 'Other Topics', 'Get Involved', 'License', 'Privacy', 'Support & Contact', and 'Code of Conduct'. The main content area has a large heading 'MSYS2' and a subtitle 'Software Distribution and Building Platform for Windows'. Below this is a paragraph: 'MSYS2 is a collection of tools and libraries providing you with an easy-to-use environment for building, installing and running native Windows software.' This is followed by a paragraph: 'It consists of a command line terminal called mintty, bash, version control systems like git and subversion, tools like tar and awk and even build systems like autotools, all based on a modified version of Cygwin. Despite some of these central parts being based on Cygwin, the main focus of MSYS2 is to provide a build environment for native Windows software and the Cygwin-using parts are kept at a minimum. MSYS2 provides up-to-date native builds for GCC, mingw-w64, CPython, CMake, Meson, OpenSSL, FFmpeg, Rust, Ruby, just to name a few.' Below this is another paragraph: 'To provide easy installation of packages and a way to keep them updated it features a package management system called Pacman, which should be familiar to Arch Linux users. It brings many powerful features such as dependency resolution and simple complete system upgrades, as well as straight-forward and reproducible package building. Our package repository contains more than 3700 pre-built packages ready to install.' At the bottom is a paragraph: 'For more details see What is MSYS2? which also compares MSYS2 to other software distributions and development environments like Cygwin, WSL, Chocolatey, Scoop, ... and Who Is Using MSYS2? to see which projects are using MSYS2 and what for.' On the right side of the main content area is a 'Table of contents' section with links to 'Installation', 'Sponsors', 'Authors and Contributors', and 'Donations'.

WINDOWS BUILD SYSTEM REWRITE

- pacman to handle Windows builds almost feels like using ArchLinux, and the AUR (ArchLinux User Repository) is a good baseline to build some dependencies yourself - and VIRUP already supports ArchLinux

With *quasi-msys2* (github.com/HolyBlackCat/quasi-msys2), you can use MSYS2 packages on a Linux machine to cross-compile

- Runs on a Linux machine (self-host is easy, even on dev machine), uses Wine for Windows-only tools (like Qt moc for Windows) and cross-compiles using Clang
- You can use docker to quickly build VIRUP.exe from any Linux machine
- Unlimited power : faster CI/CD means faster iteration to write build scripts, adding dependencies is not tedious anymore

There are still two dependencies that cross-compile badly and require a Windows worker with MSYS2 (compiled for 15 minutes once every few month).

VULKAN PORT STATUS

VULKAN PORT STATUS

- Successor to OpenGL
- Portable GPU API that is low-level and generic (can be used for both direct rendering to screen and GPU compute at the same time)
- Mainly used for accelerated graphics but it became so generic, portable and efficient some people started using it as a portable CUDA replacement (actually VIRUP uses the Vulkan backend of Whisper instead of the CUDA backend)



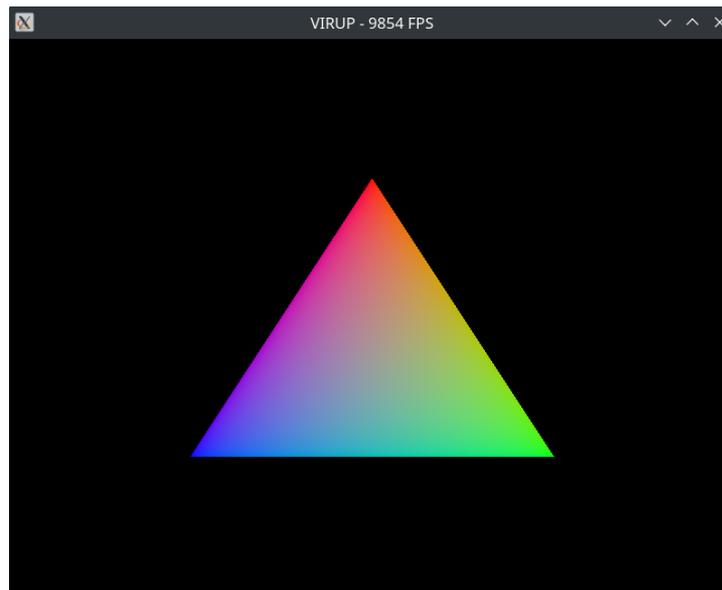
VULKAN PORT STATUS

- Better optimization opportunities than on OpenGL 4.5, especially to remove frame drops related to memory allocation and CPU/GPU synchronization
 - Not really VIRUP's issue (it's already GPU-bound most of the time), but nice to have
- Supported on more systems : macOS (using MoltenVK), ARM-based VR headsets, mobile, ...
 - Real benefit for VIRUP



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FUTURE

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- Wrap up repositories work (the difficult part is behind us, some file formats just have to be swapped for HTTP-compatibility)
- Chatbot is ready for publication, together with the repositories it means VIRUP got two major features within the past year. So stay tuned for a coming major version release soon with updated documentation.
- The Vulkan port will be worked on in parallel and can hopefully be done within a reasonable time frame. But it's too big to put all the other developments on hold for an undetermined time.

FUTURE

- The first steps of the year to come will involve integrating new data to our repository and help kickstart a repository ecosystem
- So please contact me for new dataset integration ideas, it's time !

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- Those data types are already there and can probably be integrated with low effort :
 - Cosmological simulation snapshots
 - CSV catalogs of stars or galaxies
 - Volumetric data



**Thank
you !**

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go.epfl.ch/VIRUP

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