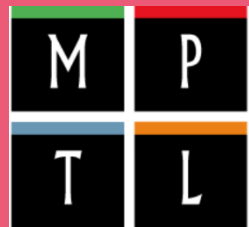


Using low-cost and standalone
Virtual and **Augmented Reality**
headsets to teach and learn
motion concepts



2023

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Co-founder of **Level Up s.r.l.**

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VR/AR headsets in the classroom



Astronomy (e.g. Titans of Space PLUS)

EARTH
12,756 km across

The MOON
3474 km

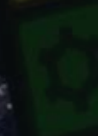
Look no further than our own planet -



- for incredible beauty and precious life.

we are incredibly lucky to have a moon
as large and as close as ours.

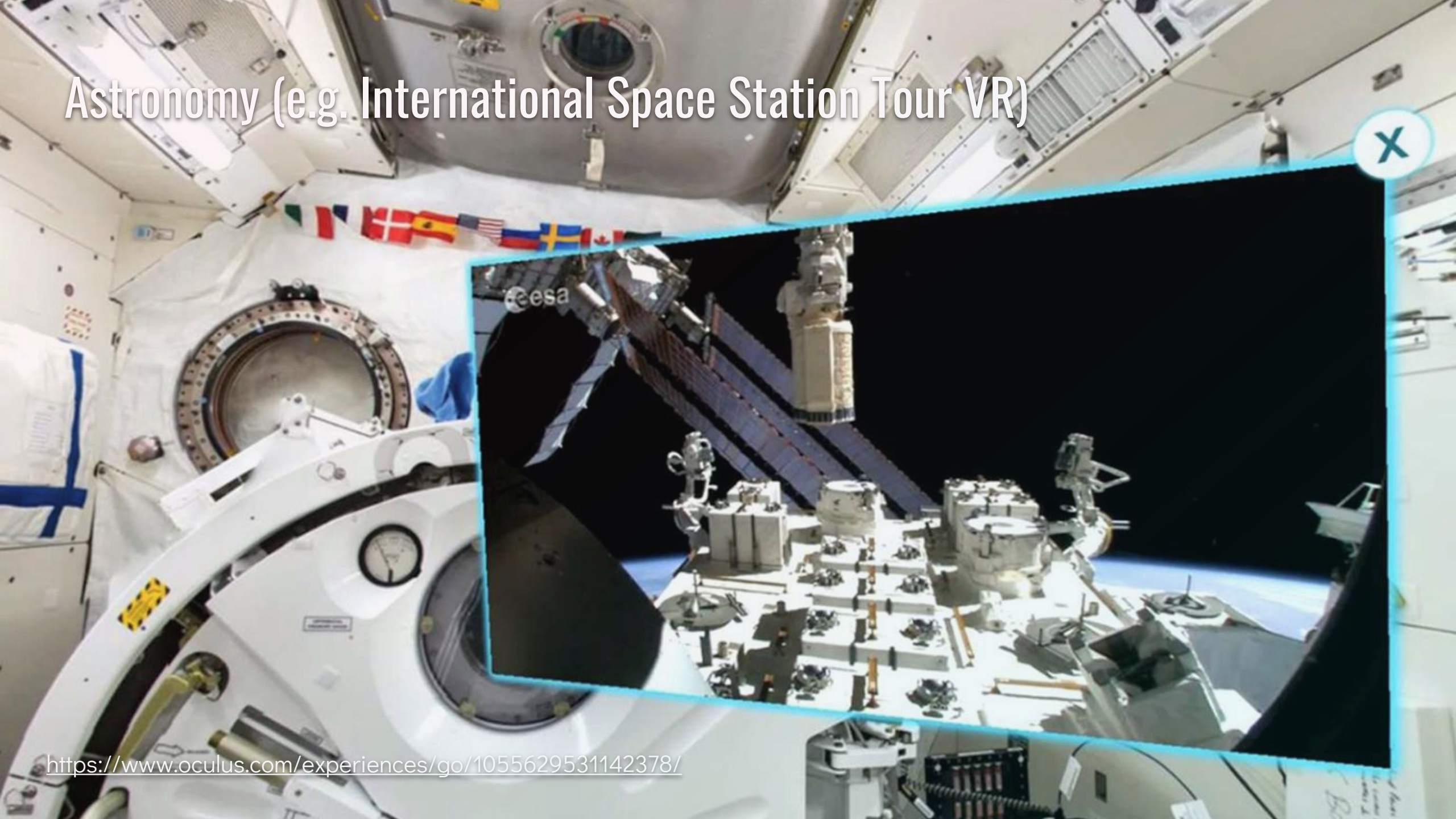
6/6



READY

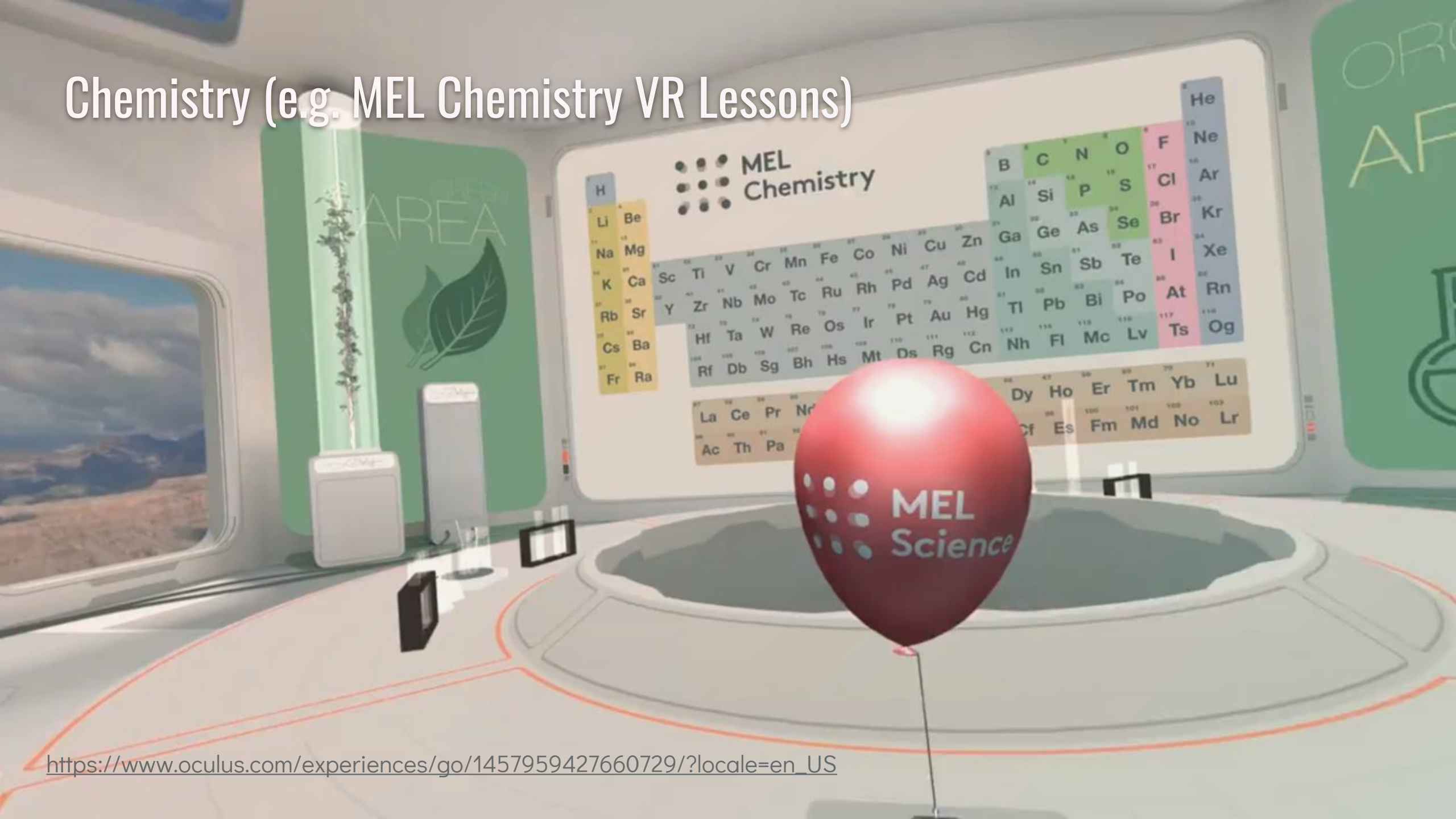
2%

Astronomy (e.g. International Space Station Tour VR)



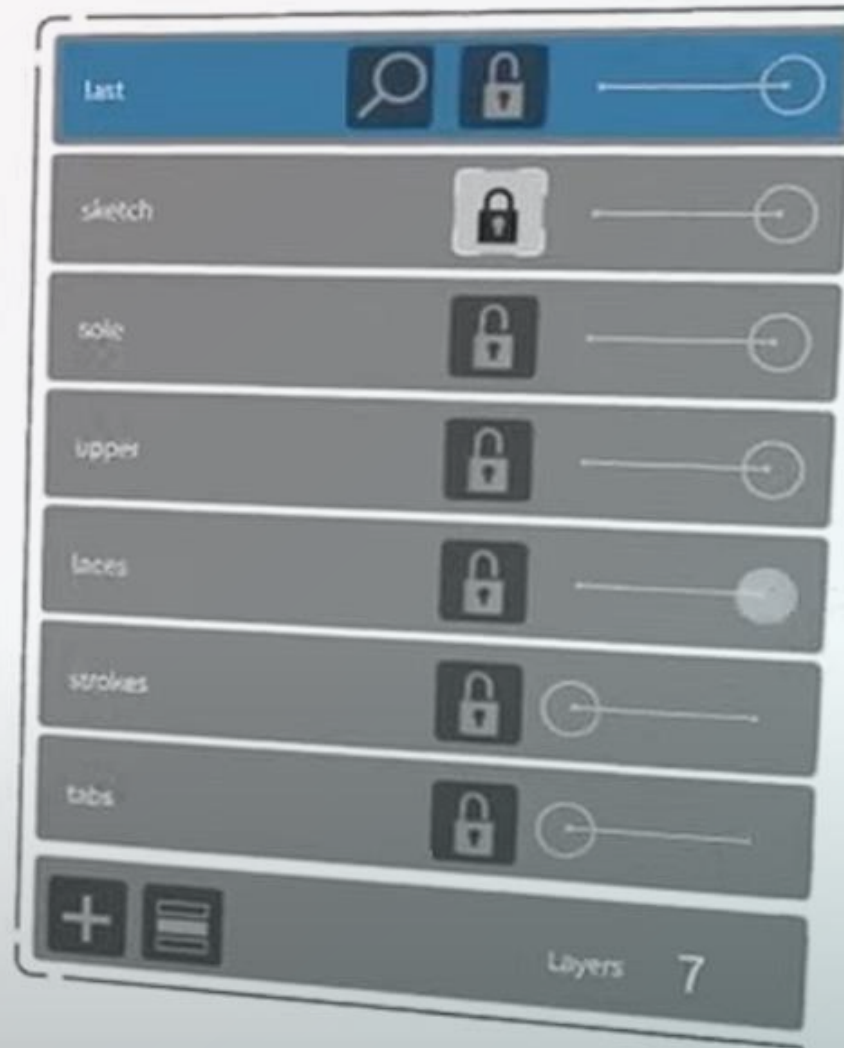
<https://www.oculus.com/experiences/go/1055629531142378/>

Chemistry (e.g. MEL Chemistry VR Lessons)



https://www.oculus.com/experiences/go/1457959427660729/?locale=en_US

3D drawing and sculpting (e.g. Gravity Sketch)

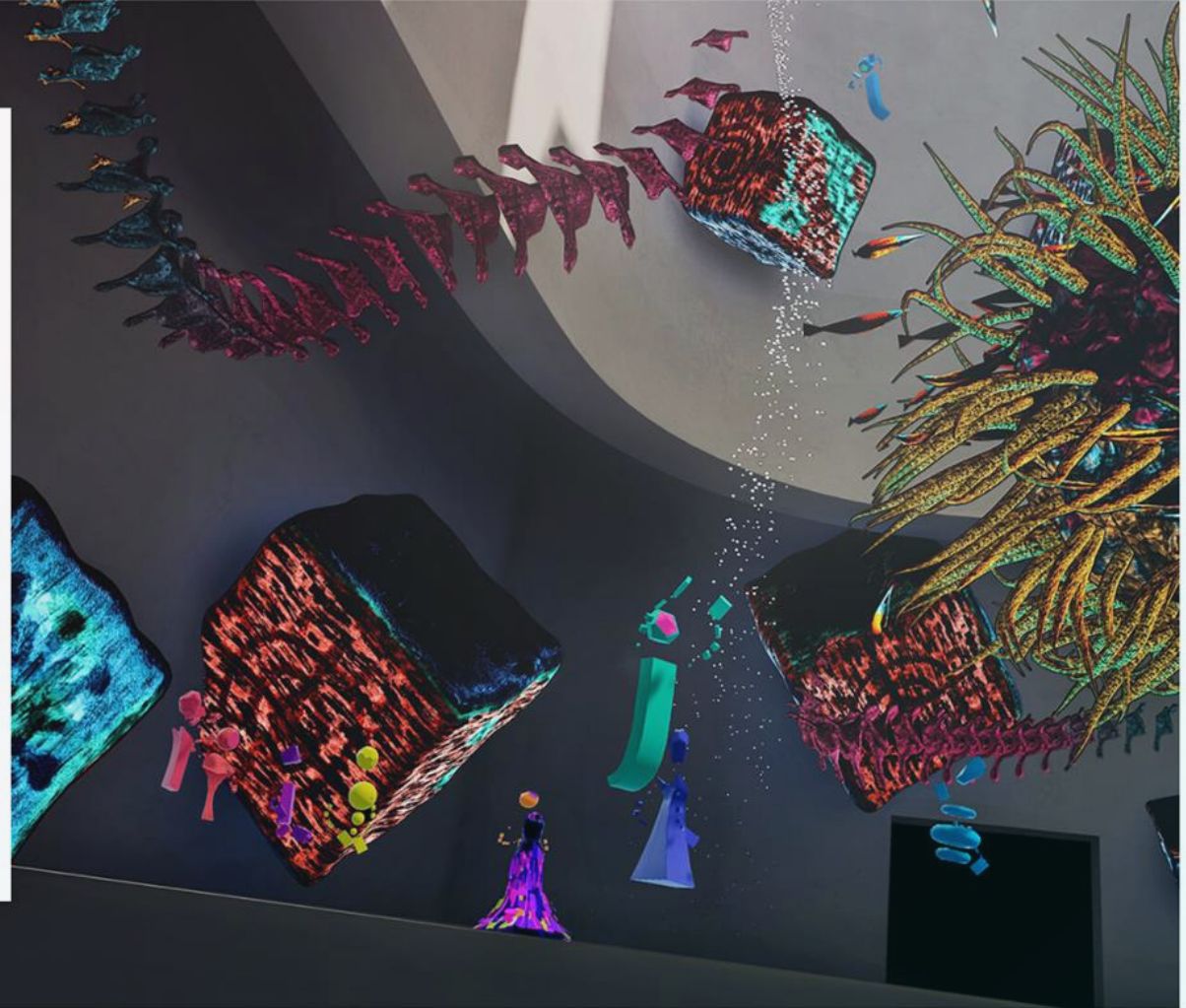


Virtual Museums (e.g. Museum of Other Realities)

A New Frontier for Art

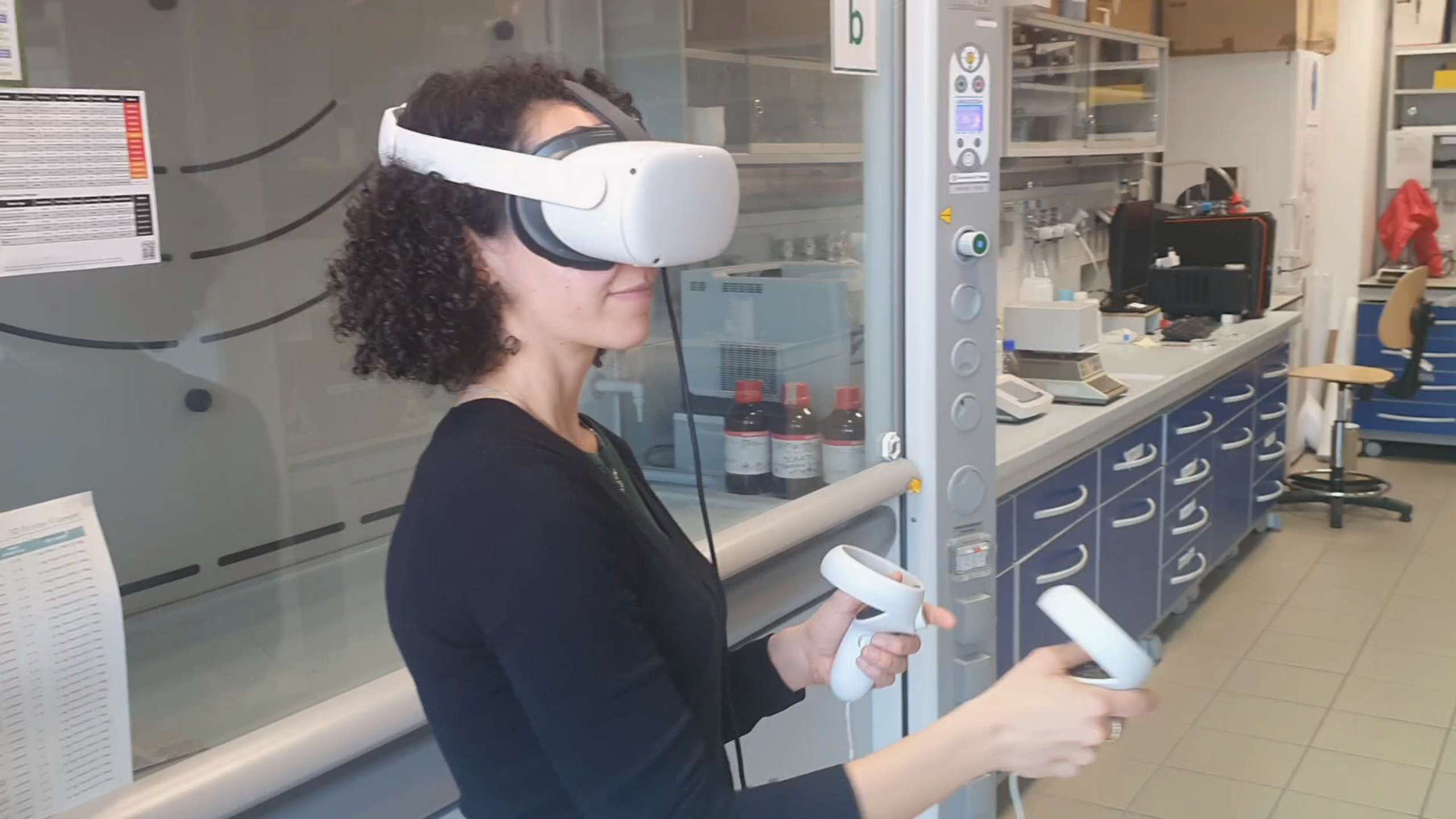
An immersive art showcase. Step into a painting, surround yourself with fantastic sounds, experience art as it evolves and takes form. The MOR is an evolving experience, featuring new art on an ongoing basis.

[VIEW THE COLLECTION](#) →



AR headsets





∞ Meta Quest / Quest 2



1. Low-cost
2. Standalone
3. Built-in see-through AR (B&W)
4. Extra: 1 USB cable for mirroring

What can AR do specifically for Physics Education?

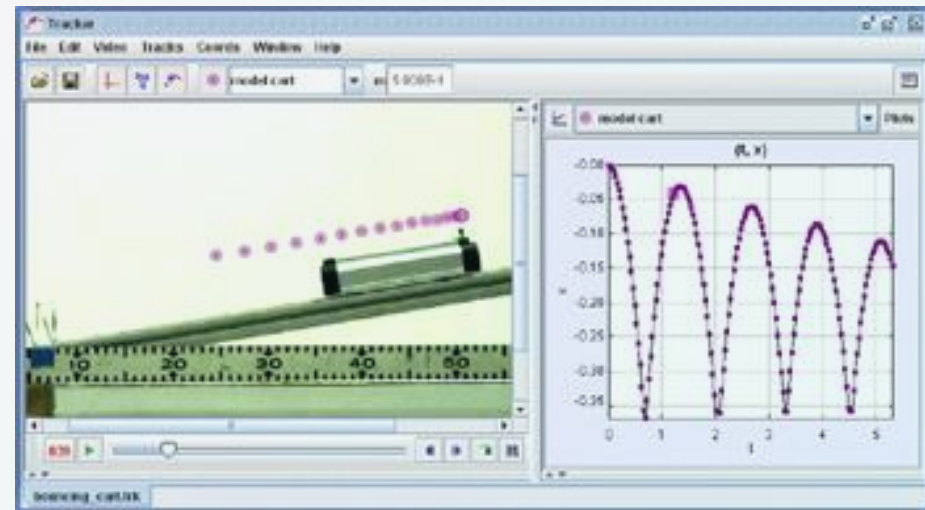
AR vs Laboratory ✗

AR in the Laboratory ✓

measurement + visualization tool

Motion tracking

A 6 DoF, AR extension of more traditional motion laboratories



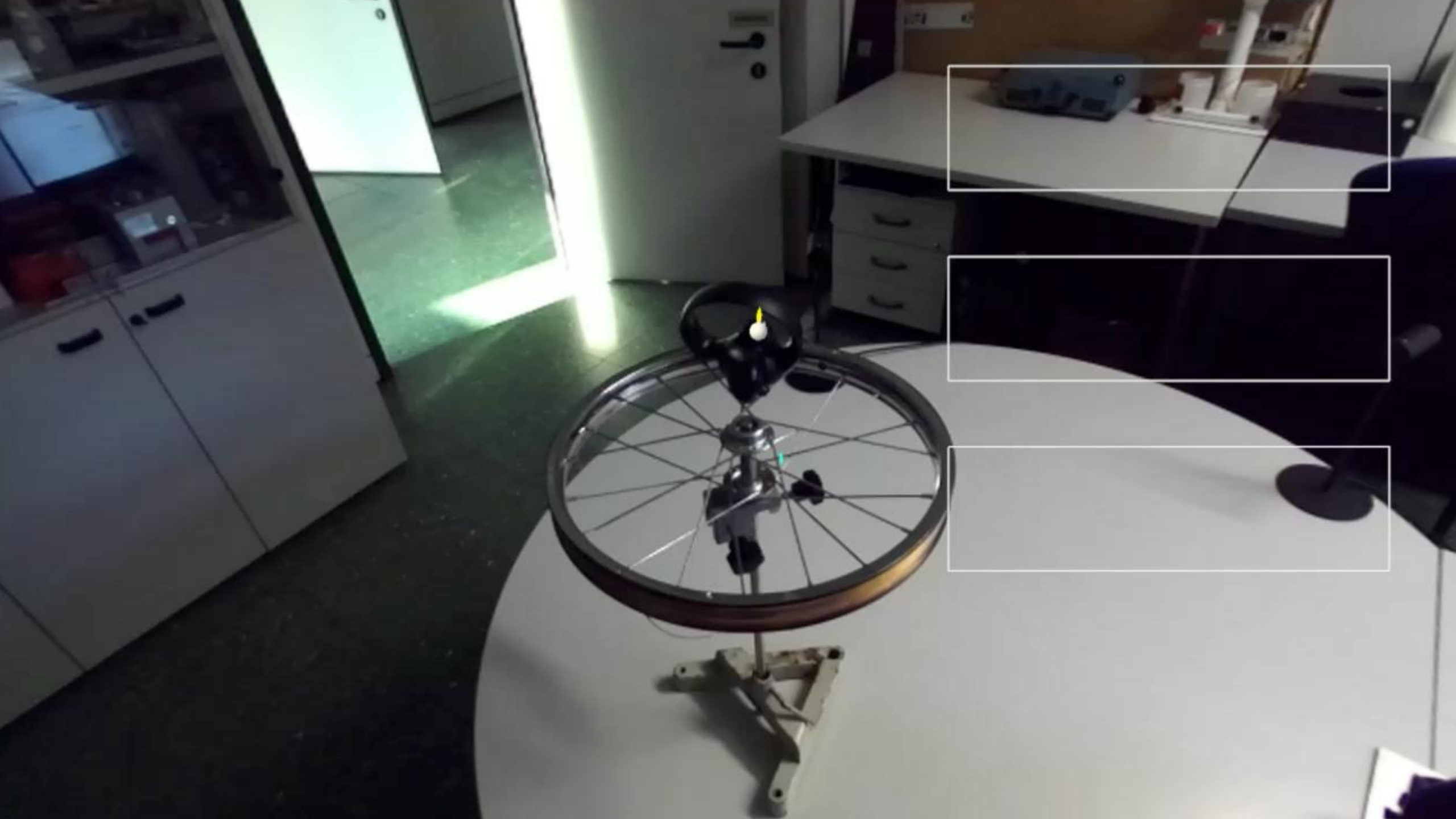
Learning motion concepts using real-time microcomputer-based laboratory tools
Thornton & Sokoloff, *Am. Journ. Phys.* **58** (1980) 858.

**Realtime
6 DOF
tracking**

Commercial virtual reality headsets for developing augmented reality setups to track three-dimensional motion in real time
T Rosi, M Perini, P Onorato, S Oss - Physics Education, 2021











Urto 3D 1

Search Sheet

Home Insert Page Layout Formulas Data Review View

Paste Calibri (Body) 12 A A- A+ General Conditional Formatting Insert Delete Format Editing

Security Warning Data connections have been disabled. Enable Content

C13 fx =data!Z13

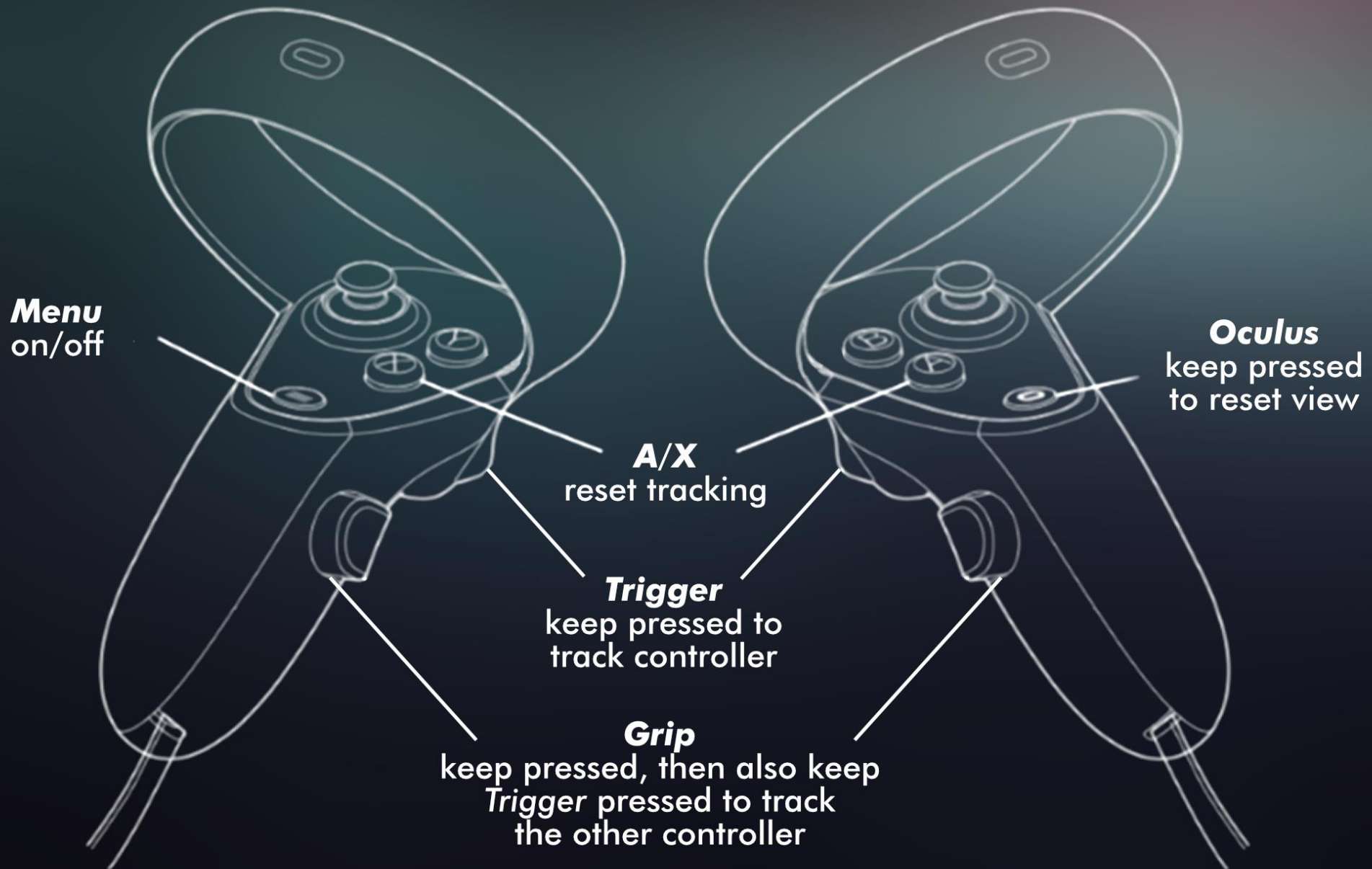
	A	B	C	D	E	F	G	H	I	J	K	LM	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF
1			Body 1				Body 2																				Body 1				
2	t (sec)	x (m)	y (m)	z (m)			x (m)	y (m)	z (m)																		vx	vy	vz		
3	0																										0	0	0		
4	0,039																										0	0	0		
5	0,065																										0	0	0		
6	0,099																										0	0	0		
7	0,132																										0	0	0		
8	0,165																										0	0	0		
9	0,198																										0	0	0		
10	0,23																										0	0	0		
11	0,262																										0	0	0		
12	0,295																										0	0	0		
13	0,328	-0,357	-0,024	1,807			-0,097	0,048	1,7303																		-0,026468	0,00128	-0,010799		
14	0,362	-0,358	-0,024	1,807			-0,098	0,048	1,729																		0,030609	-0,003781	-0,045053		
15	0,396	-0,357	-0,024	1,805			-0,097	0,048	1,7311																		0,045059	0,039412	-0,018777		
16	0,429	-0,356	-0,022	1,805			-0,098	0,048	1,7278																		0,160297	0,02162	-0,091474		
17	0,462	-0,35	-0,022	1,802			-0,097	0,048	1,73																		0,238729	0,051288	-0,152276		
18	0,496	-0,342	-0,02	1,796			-0,097	0,049	1,7297																		0,337493	0,10894	-0,324104		
19	0,529	-0,331	-0,016	1,786			-0,098	0,048	1,7292																		0,361389	0,10586	-0,435262		
20	0,562	-0,319	-0,013	1,771			-0,098	0,049	1,7298																		0,488985	0,103191	-0,590447		
21	0,596	-0,303	-0,009	1,751			-0,097	0,048	1,7309																		0,828409	0,203273	-0,269481		
22	0,629	-0,275	-0,003	1,742			-0,097	0,049	1,7298																		0,856634	0,204787	-0,044691		
23	0,662	-0,247	0,004	1,741			-0,098	0,049	1,7284																		0,834477	0,208193	-0,030713		
24	0,696	-0,219	0,011	1,74			-0,098	0,05	1,7286																		0,909618	0,177837	0,001141		
25	0,729	-0,189	0,017	1,74			-0,098	0,048	1,7291																		0,900239	0,227463	-0,035683		
26	0,762	-0,159	0,025	1,739			-0,098	0,049	1,7288																						
27	0,795																														
28	0,831																														
29	0,864	-0,097	0,007	1,717			-0,084	0,069	1,7245																		0,584136	-0,252578	-0,544153		
30	0,896	-0,078	-8E-04	1,699			-0,074	0,087	1,7111																		0,512741	-0,326593	-1,062276		
31	0,929	-0,061	-0,012	1,664			-0,064	0,103	1,6834																		0,505096	-0,340275	-1,351324		
32	0,962	-0,045	-0,023	1,62			-0,054	0,12	1,6454																		0,488604	-0,320377	-1,666278		
33	0,996	-0,028	-0,034	1,563			-0,045	0,136	1,5969																		0,497861	-0,332647	-2,30213		
34	1,028	-0,012	-0,044	1,489			-0,035	0,152	1,5345																		0,567387	-0,300313	-2,285409		
35	1,062	0,007	-0,055	1,412			-0,024	0,173	1,4584																		0,521411	-0,263926	-2,617006		
36	1,096	0,025	-0,064	1,323			-0,01	0,191	1,378																		0,492037	-0,332017	-3,606542		
37	1,129	0,041	-0,075	1,204			2E-04	0,209	1,2833																		0,424726	-0,252077	-2,642821		
38	1,163	0,056	-0,083	1,114			0,009	0,227	1,1767																		0,542704	-0,337745	-3,791262		
39	1,195	0,073	-0,094	0,993			0,017	0,245	1,0609																		0,498962	-0,385742	-4,076953		
40	1,229	0,09	-0,107	0,854			0,027	0,258	0,936																		0,554191	-0,225616	-4,321567		
41	1,262	0,108	-0,114	0,711			0,039	0,275	0,795																		0,486384	-0,282475	-4,672852		
42	1,295	0,124	-0,124	0,557			0,048	0,289	0,653																		0,54621	-0,206554	-6,227932		
43	1,329	0,143	-0,131	0,345			0,061	0,314	0,4766																		0,57883	-0,450316	-5,953539		
44	1,362	0,162	-0,146	0,149			0,071	0,333	0,302																		0,346714	-0,153566	-4,116182		



Desktop Folder

On the desktop you can find the folder "MPTL" with informations & instructions

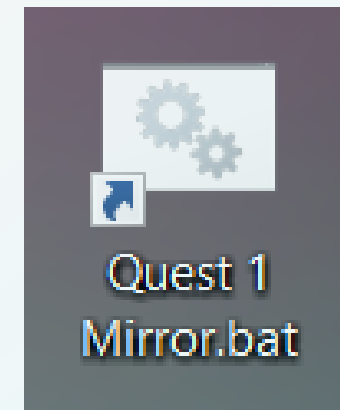
AAALA 2023 controls



MIRRORING



USB-C cable to mirror the headset on a monitor or a projector (needed only for AR)





Last notes

Real, “augmented”, experiments: VR/AR headsets are high quality measurement tools

VR/AR: barriers are lowering (cost, learning curve, user experience...)

Data can be exported and shared

Simulations can be added and compared to experimental results

Critical issues:

- knowing the technology
- setup and organization
- development of specific curricula

<https://www.leveluptrento.com/anreal>



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complimenti e buon lavoro - Stefa

È STATO BELLISSIMO!!! (LA NOSTRA PIÙ BELLA DEL MONDO)

SPETTACOLARE
Grazie Fran

Bellissimo non immaginavo fosse così divertente -
Pietro

mi è piaciuta soprattutto le aquile che stanno
in equilibrio sul becco e le onde.

MI SONO PIACIUTE TUTTE LE COSE.

CHIARA

VITTORIA

MI È PIACIUTO TUTTO, È BELLISSIMO

mi è piaciuto più di tutto il cannone
ad aria. Mamma di vittoria e Filippo

VORTEX
VIOLA

8 Paga Paolo?

Contacts



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