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## Virtual and augmented environments for communicating Astronomy: Science, Education and Outreach experiences at INAF Palermo Observatory

The use of Augmented Reality (AR) and Virtual Reality (VR) in astronomy has been recognized as a very powerful tool, both for researchers, to better visualize and analyze astronomical data, and for educators to provide immersive, interactive and engaging learning spaces. By the use of a camera and an appropriate software, AR technology integrates and expands the surrounding reality with additional elements, thus making the real world and the virtual world coexist. The superimposition of elements such as videos, pictures, texts, sounds, games, virtual tours, 3D models, offers many effective and interactive solutions to explain science. VR is a technology based on the principle of interaction between a user and a computer, that can transmit in real time the illusion of being in another place and simulate the execution of actions like exploration, movement, touch. The visualization of astronomical data in 3D models, which are not a trick of computer graphic, but just science performed into the observatory, and the use of VR for public engagement allow the community to be at the cutting edge of science and technology. To show what powerful means AR and VR are for communicating astronomy and as examples for other astronomy outreach projects, we will show some experiences carried on in the last years at the INAF Palermo Observatory by the 3DMAP-VR team and in the framework of the PRIN INAF project "Virtual Reality and Augmented Reality for Science, Education and Outreach". This kind of tools can be effectively used to spread Ahead in the near future.

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