Immersive Virtual Reality Technologies as a New Platform for Science, Scholarship, and Education

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A New Technology Is Emerging:

Immersive Virtual Reality (VR), and Virtual Worlds (VWs). They represent a new way in which people can interact with each other, and with informational constructs. These technologies work much better on a subjective level, than the traditional Web flat-browser paradigm. They will likely become a standard interface to the next-generation, 3-D Web, and the human telepresence and connectivity.

This technology is still in an embryonic stage (~ like the Web was circa 1992 or so), but its promise is unmistakable for anyone who gives it a serious look. We will likely see a synergy of the informational content (and the expanded functionality) of the Web, and both the immersive and augmentative VR as interfaces to it. *Science, scholarship, and education* (along with everything else*) will be transformed and enhanced by it.*

The way in which we interact with computers, and with each other, and with the world of information using computers, is evolving
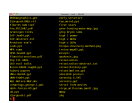
From ASCI text terminals …

… to Web browsers and hypertext …

… and now immersive virtual environments

Towards The Immersive 3-D Web:

While these technologies originated from video games, they are now enabling a much more serious, fundamental change in the way we will be storing, representing, and accessing information and interact with each other. The 3-D world is our "natural" environment, and the continuing virtualization of science, scholarship, commerce, economy, entertainment, etc., is inevitably evolving in this direction.

Major IT industry players, including Intel, IBM, Cisco, etc., are very actively pursuing these technologies. At the *Supercomputing '09* conference, Justin Rattner, the CTO of Intel, declared the 3-D web to be the key driver for the future of high-performance computing.

Many other companies, over 300 universities, media, gov't agencies, etc., already have a strong and growing presence in VWs.

MICA: The Meta-Institute for Computational Astrophysics
The first professional scientific organization based entirely in VWs

#### The Goals Of MICA Include:

- Exploration, development and promotion of VWs and VR technologies for professional research in astrophysics and related fields.
- Providing and developing novel social networking venues and mechanisms for scientific collaboration and communication, including professional meetings, effective telepresence, etc.
- Use of these technologies for education and public outreach.
- Exchange of ideas and joint efforts with other scientific disciplines in promoting these goals for science and scholarship in general.
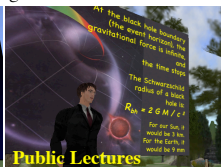

Meta Institute for Computational Astrophysics
Exploring Astrophysics in Virtual Worlds

Professional members of MICA (currently ~ 50 people) include faculty, postdocs, staff scientists, and graduate students in physics, astronomy, computer science, and related fields; IT professionals and engineers; educators; and others contributing to the professional work of MICA.

MICA affiliates (currently ~100 people) include science enthusiasts, students, and members of the general public interested in astronomy, science in general, and the uses of VWs as a learning and communication platform.

Some of the MICA Activities:
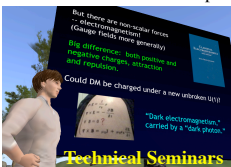
Technical Seminars   **Public Lectures**   **Collaboration Meetings**

Virtual Conferences and Workshops

What Can MICA Do For *You?*

- Network with colleagues world-wide, establish new collaborations
- Attend seminars, group discussions, and public lectures, which you may not be able to do at your home institution
- Participate in our research activities, exploring the uses of VR technologies for science and scholarship
- Develop new educational and outreach activities, remote learning, etc.
- Be a part of what may be a major change in the way humanity uses information technology

Find out for yourself …

Contact one of us, or any of the other professional members listed on http://mica-vw.org. We'll help you get started, and soon you'll be able to explore on your own.

Some Ongoing Research Activities:

Immersive Data Visualization

Immersive, interactive approach to visualization and exploration of highly-dimensional, complex data sets. Humans are intrinsically "optimized" to perceive information and interact with the world in 3-D.
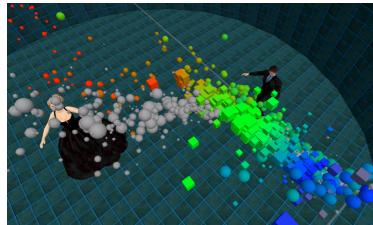
A Novel Approach To Numerical Simulations:

Scientists immersed into their simulations, controlling them and visualizing the results in a real time, and interacting with each other, as well as with their numerical experiments: **http://manybody.org/wiki/**
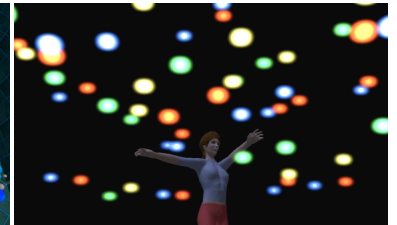

What VR offers beyond the standard 3-D plotting packages is the feeling of immersion in the data spaces, and the ability to explore them jointly with your colleagues – and without the need for a costly or non-portable equipment (e.g., "caves", 3-D goggles, etc.) – *anybody can do this on their laptop or a desktop at a zero cost.*

Where do we go next?

While we used the commercially operated VWs of *Second Life*™ (SL) and *Qwaq Forums* (now *Teleplace*) for our initial experiments, we are now moving towards the use of *OpenSim*, an open source version of the SL technology, and an emerging standard: see *http://opensimulator.org*

With *OpenSim*, any university or other organization can run its own VW (aka *grid*), and use it for research, educational, or other professional activities, avoiding the peculiarities which often affect commercial VW venues like SL.

Different VWs can then interoperate using the emerging *HyperGrid* technology; this may be the start of the true 3-D Web.

Optimal 3-D Displays of Structured Information
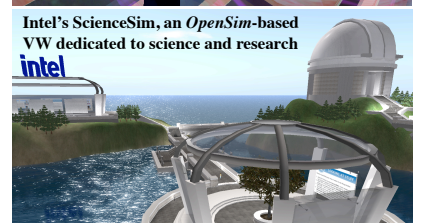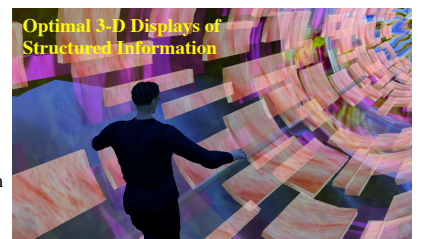
Intel's ScienceSim, an *OpenSim*-based VW dedicated to science and research

★ For more details, please see **http://mica-vw.org**