
T. HANSTEEN

Planetariums — not just for kids

Planetariums are not just for education, or even astronomy: they could display all sorts of data, if only scientists thought to use them, says **Tom Kwasnitschka**.

Most researchers think of planetariums, if they think of them at all, as a place to take schoolchildren for whizzy trips through the stars, with nothing to offer serious scientists. But the truth is quite the contrary.

In March, the National Astronomical Observatory of Japan held a joint workshop with the International Planetarium Society (IPS) in Tokyo. The goal? To visualize the most complex astronomical data sets gathered so far and thus explore ideas about the distribution of galaxies, exoplanets and the make-up of comets. And planetariums can display more than astronomical data. In the past five years, I have been immersed in visualizations of neuronal activity, Hurricane Katrina, particle collisions from the Large Hadron Collider, marine food webs along the US Northwestern Pacific coast, and the magma chamber under the Yellowstone Plateau in Wyoming.

With rich detail and dynamic configurations, these visualizations are often works of art. They inspire both wonder and scientific insight.

Rather than chasing grants for immersive-visualization infrastructure, researchers should use what is already available. With up to 20 high-performance video projectors linked to advanced graphics computers, digital dome planetariums host some of the most sophisticated and flexible systems for scientific visualization. The IPS estimates that there are around 1,300 digital domes in operation globally, each measuring between 3 and 30 metres across, and that one is available within easy reach of most academic facilities. What's more, busy researchers can rely on planetarium staff to handle most of the underlying logistics.

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Dome software can run on any sort of computer, from a laptop to a graphics cluster. It produces seamless, real-time images at a resolution near the limit of what the human eye can discern. A module made to display stars can be easily rewritten to show the global pattern of earthquakes. With a simple Excel spreadsheet of bird-migration routes plotted on a digital globe, I can 'fly' to virtual locations and adjust the spreadsheet in real time.

Virtual-reality headsets and other technologies designed for individual viewers have improved markedly, but they lack the communal experience of 'mixed reality'. My research on deep-ocean volcanoes relies on an inverted dome — imagine a gigantic salad bowl with researchers standing in the middle — that I designed on the basis of experience and contacts from working in planetariums since my teenage days as a guide. When my colleagues and I are immersed in this visual environment, we can really communicate about our data. We see the same things and point them out to each other. We discuss hypotheses face to face as humans, not as avatars. There are no clunky goggles to isolate us and stifle conversation.

I'm not a planetary scientist, but research in the deep ocean is similar to studying Mars: because we cannot go there ourselves, we need elaborate robotics to do our exploration. A huge limitation is our inability to see the sea floor with our own eyes, and to gain the sense of presence that field geologists can work from. The displays we created showed us that ocean-floor surveying had not caught up with our visualization capabilities; this led us to develop deep-sea camera technology to enable photorealistic models of the sea floor. (In fact, as I write this, I am on a boat that's scanning the floor of the Mediterranean Sea.)

Planetarium capacity is growing. A US$2-million digital upgrade of the Iziko Planetarium in Cape Town is being funded by the museum and local universities with the expectation that it will also serve as a facility for researchers. The European Southern Observatory Supernova Planetarium, scheduled to open near Munich, Germany, next year, is charged with supporting both research and education. Already, software originally written for educational planetarium shows is being used by NASA to review space missions and to aid forecasts of 'space weather', such as solar flares that can disrupt radio communications.

The IPS's Data to Dome initiative is working to make it easier to import and explore scientific data across all disciplines. A similar project, headed by the European Southern Observatory and its industrial partners, is currently developing ways for astrophysical data to be broadcast to planetariums, so data sets can be made available at the same instant as a press release. Open-source software projects, such as OpenSpace and WorldWide Telescope, are being written with planetarium domes in mind. We can even gather with colleagues in domes across the world, because they can be linked together over the web like a giant teleconferencing portal.

How can scientists gain access to planetariums? The planetariums are eager for collaborations. They have realized that they need to do more than explain the phases of the Moon. They want to present cutting-edge research that is already available over other media channels, and to do it better. But only the biggest venues have the funds and the staff to reach out to scientists directly.

Thanks to the advances made in visualization technologies over the past ten years, planetariums are, for the first time, able to give back to the scientific world. The scientific community should embrace these facilities as a resource. ■

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