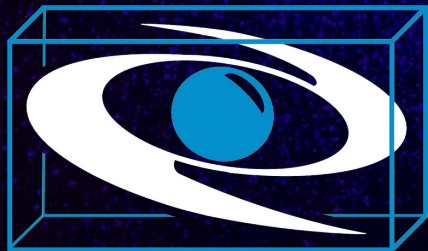


The Data2Dome initiative at the Iziko Planetarium & the IDIA Visualisation Lab



IDIA | VISLAB

Dr Lucia Marchetti - @Luci_aMarchetti

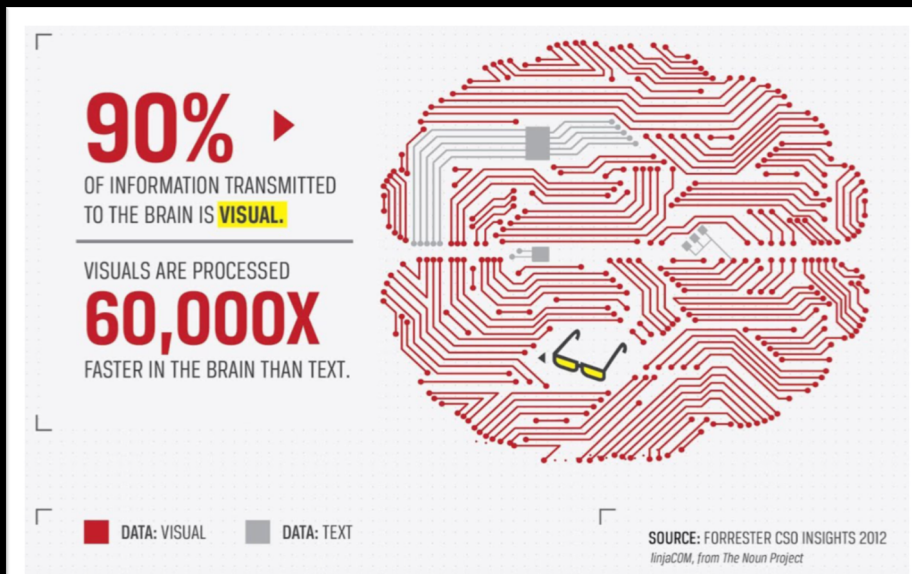
T. H. Jarrett, A. Sivitilli, A. Comrie, S. Macfarlane, R. Taylor, M. Cluver



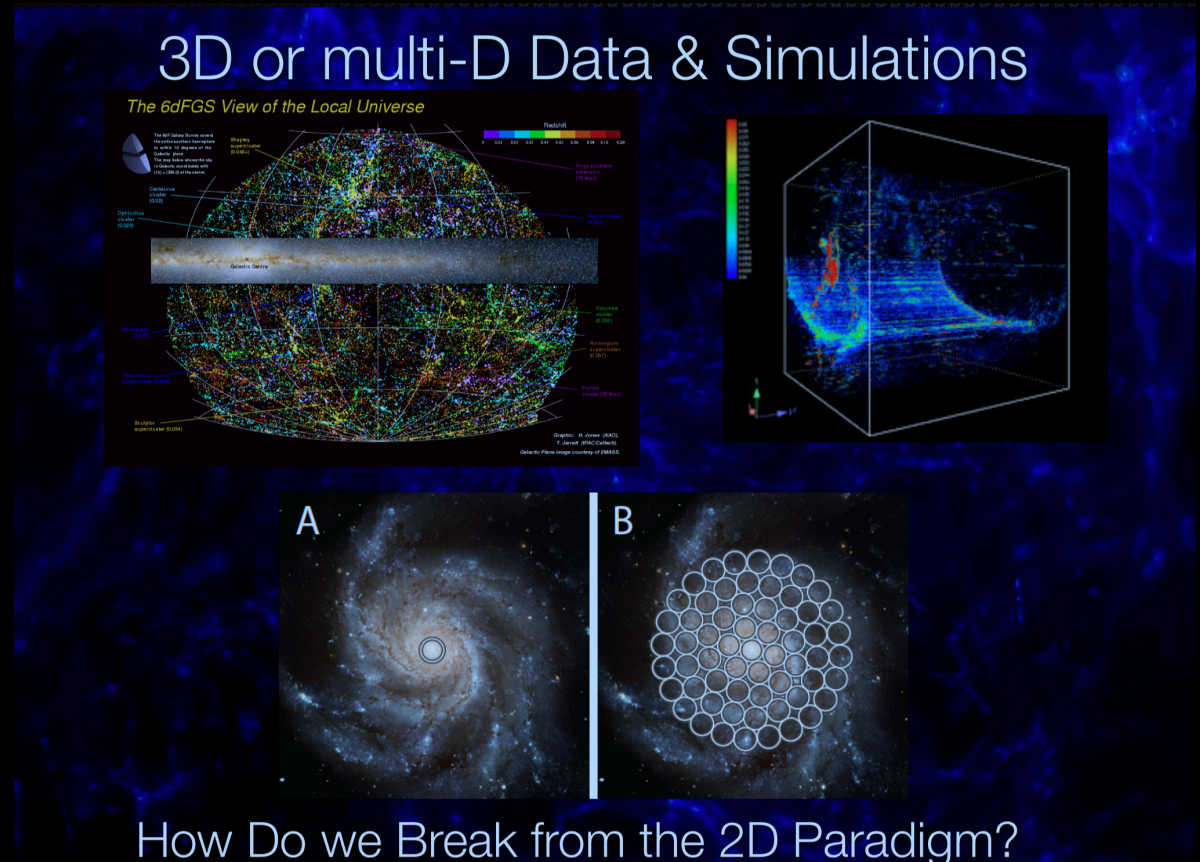
How to make sense of so much data?



MeerKAT



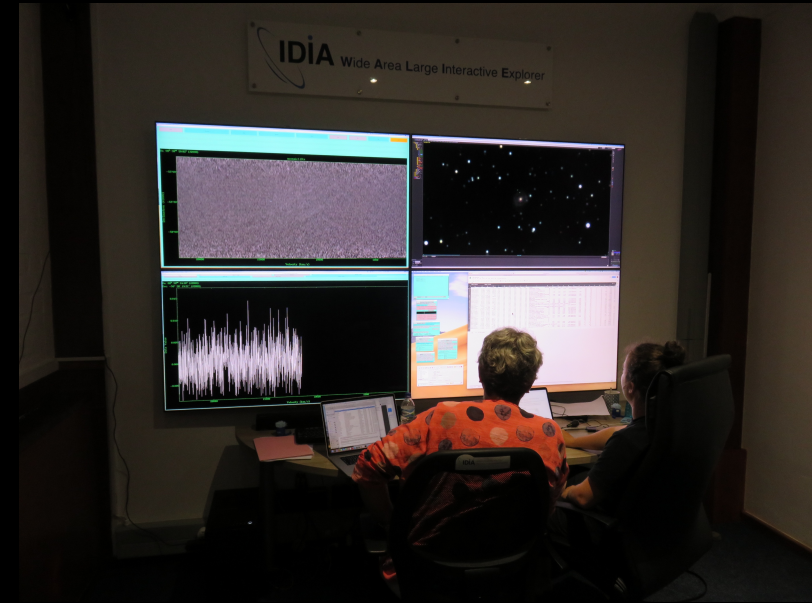
The greatest value of a picture is when it forces us to notice what we never expected to see - *John Tukey*





IDIA | VISLAB

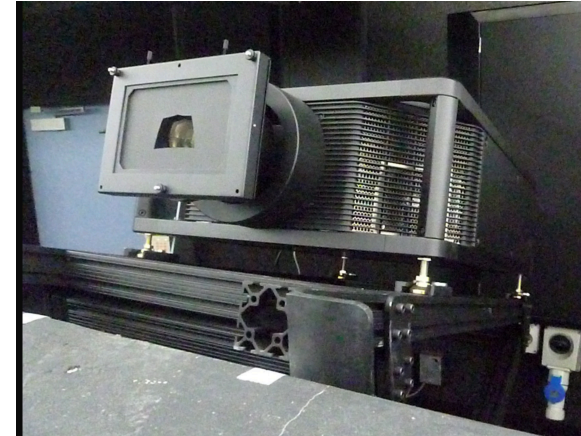
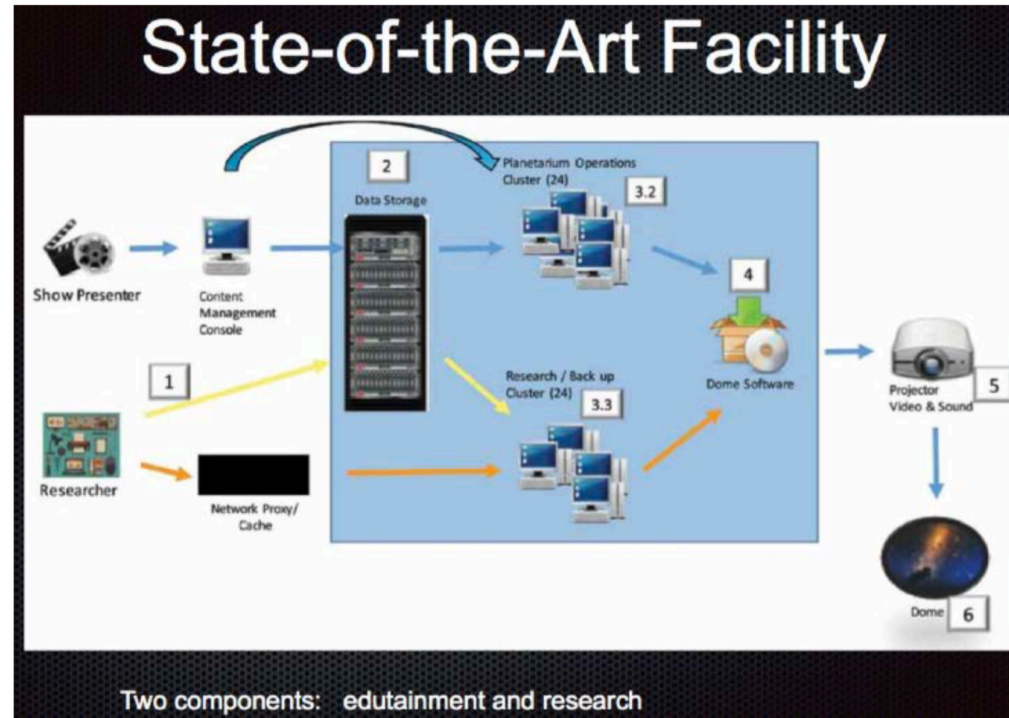
The Iziko Planetarium & the IDIA Visualisation Lab



1. Iziko Planetarium & Digital Dome



Digital Dome Facility



Two computer clusters, one for production and shows, the other for research. Each cluster has 14 computers (NVIDIA P6000 GPUs) that drive six 4K Sony laser projectors

Sky-Skan was the primary contractor, and Ds-Dark Matter is the workhorse control software → But as research facility we are experimenting also with others...

The Data2Dome initiative

**DATA2DOME IS AN INITIATIVE OF THE INTERNATIONAL
PLANETARIUM SOCIETY (IPS) AND THE EUROPEAN
SOUTHERN OBSERVATORY (ESO)**



<http://www.data2dome.org>



Dr Mark Subbarao (President of the IPS)

**BRINGING TOGETHER ASTRONOMY DATA
PROVIDERS, SCIENCE CENTER
PROFESSIONALS, AND SOFTWARE VENDORS TO
ADVANCE THE STATE OF THE ART IN BIG DATA
VISUALIZATION**

IDEAS: Immersive Dome Experiences for Accelerating Science

[Jacqueline K. Faherty](#) (American Museum of Natural History Hayden Planetarium), [Mark SubbaRao](#) (Adler Planetarium, International Planetarium Society), [Ryan Wyatt](#) (California Academy of Sciences), [Anders Ynnerman](#) (Linköping University), [Neil deGrasse Tyson](#) (American Museum of Natural History Hayden Planetarium), [Aaron Geller](#) (Adler Planetarium Northwestern University), [Maria Weber](#) (Adler Planetarium University of Chicago Delta State University), [Philip Rosenfield](#) (AAS WorldWide Telescope), [Wolfgang Steffen](#) (Instituto de Astronomía UNAM), [Gabriel Stoeckle](#) (Natural History Museum Vienna), [Daniel Weiskopf](#) (Visualization Research Center University of Stuttgart), [Marcus Magnor](#) (Computer Graphics Lab TU Braunschweig), [Peter K. G. Williams](#) (Center for Astrophysics Harvard & Smithsonian American Astronomical Society), [Brian Abbott](#) (American Museum of Natural History Hayden Planetarium), [Lucia Marchetti](#) (University of Cape Town Iziko Planetarium and Digital Dome), [Thomas Jarrett](#) (University of Cape Town Iziko Planetarium and Digital Dome), [Jonathan Fay](#) (AAS WorldWide Telescope), [Joshua Peek](#) (Space Telescope Science Institute and Johns Hopkins University), [Or Graur](#) (Center for Astrophysics Harvard & Smithsonian), [Patrick Durrell](#) (Youngstown State University Ward Beecher Planetarium), [Derek Homeier](#) (Förderkreis Planetarium Göttingen), [Heather Preston](#) (Calusa Nature Center & Planetarium), [Thomas Müller](#) (Haus der Astronomie & MPIA), [Johanna M Vos](#) (American Museum of Natural History), [David Brown](#) (Microsoft Research), [Paige Giorla Godfrey](#) (Slooh), [Emily Rice](#) (CUNY Macaulay Honors College), [Daniella Bardalez Gagliuffi](#) (American Museum of Natural History), [Alexander Bock](#) (Scientific Computing and Imaging Institute, University of Utah)

(Submitted on 11 Jul 2019)

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<https://arxiv.org/abs/1907.05383>

The “astro” data visualisation pipeline

1. imaging, 3D catalogues, volume renders, vids >> immersive environment
2. Transform — data “format” to ingest into the system



Ascii or binary formats: VOT (xml), .speck

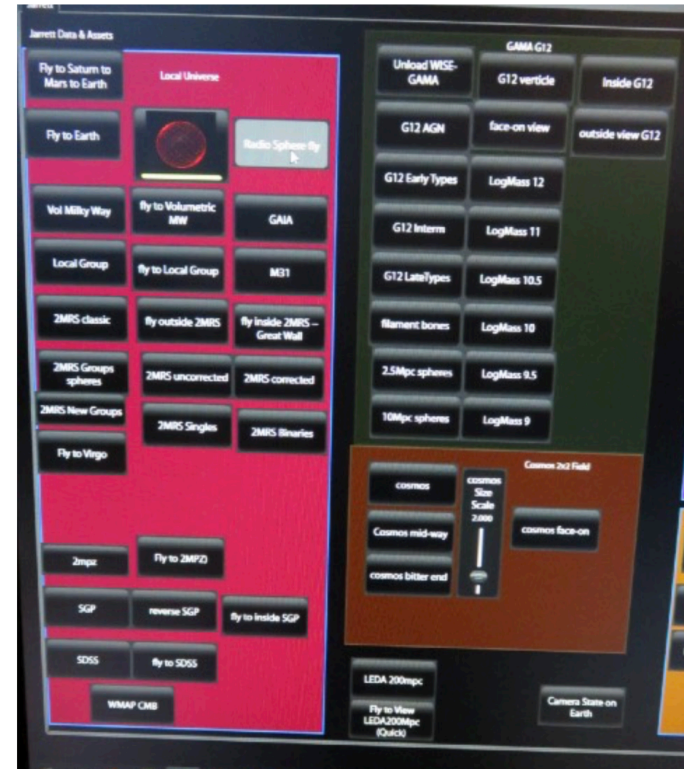
X,Y, Z (units == Mpc)

Attributes (colors, brightness, size)

Ancillary information: attributes that require their own visualisation (e.g. mass, sfr, etc..)

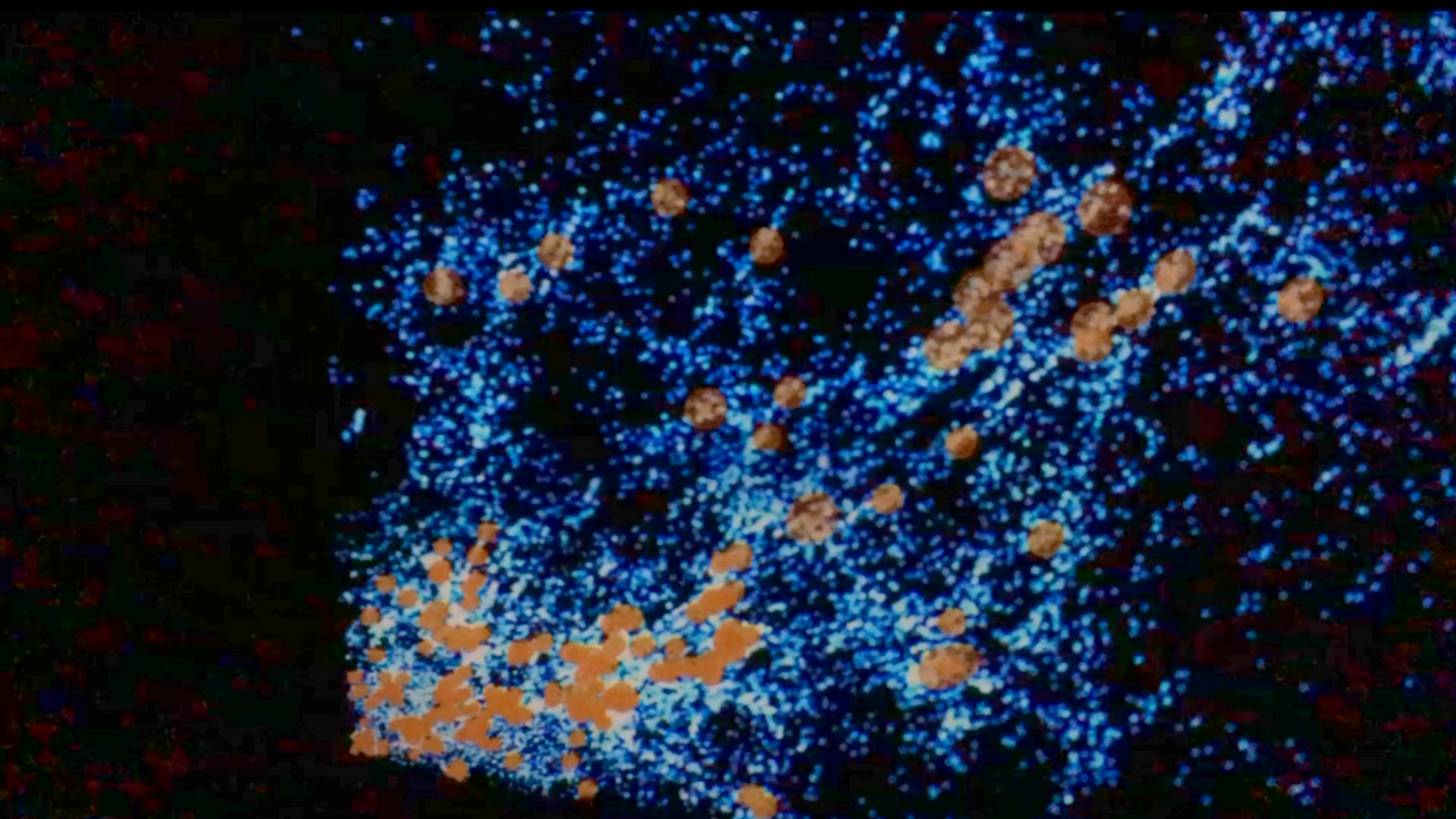
The “astro” data visualisation pipeline

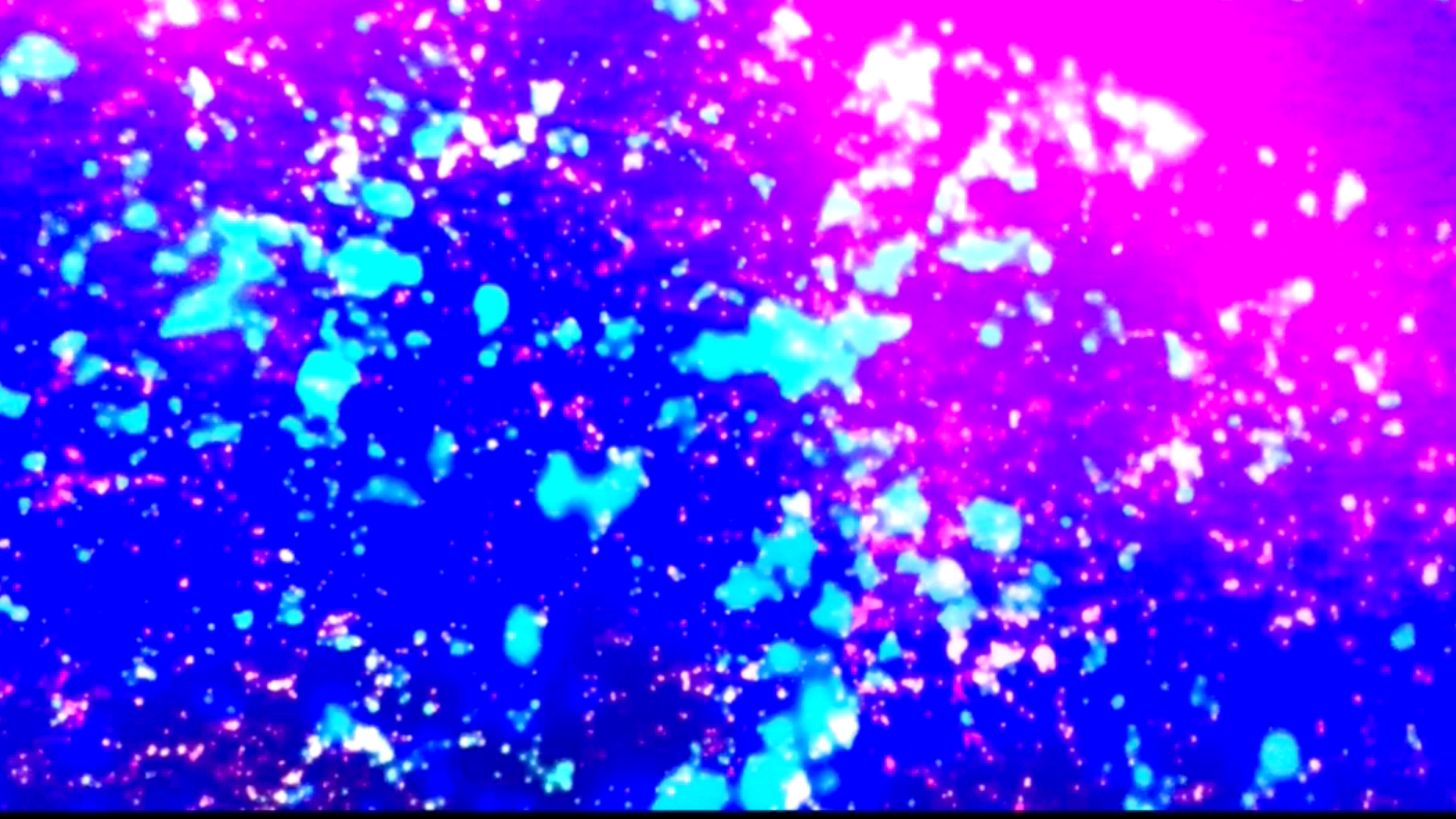
1. imaging, 3D catalogues, volume renders, vids >> immersive environment
2. Transform — data “format” to ingest into the system
3. Create “data asset” — ingest into the system



The “astro” data visualisation pipeline

1. imaging, 3D catalogues, volume renders, vids >> immersive environment
2. Transform — data “format” to ingest into the system
3. Create “data asset” — ingest into the system
4. Calibrate — adjust and fine-tune to satisfy criteria
5. Deploy — researchers interrogate data using the system





Data to Dome Workshop @ Colgate University

October 18 - 20, 2019



Description

The Data to Dome workshop, organized by the Ho Tung Visualization Lab at Colgate University, the University of Cape Town and Iziko Planetarium Research Consortium, and the International Planetarium Society will be held **October 18 - 20, 2019** in Hamilton, NY on the Colgate University campus. This workshop will bring together planetarium professionals, faculty from multiple disciplines, and visualization experts to collaborate on big data for the immersive visualization setting of the planetarium."

All participants will engage in hands-on workshops to learn how to create stunning visualizations from research data for interactive use. There is limited space, so be sure to reserve your spot soon.

Hosts

International Planetarium Society (IPS)
Colgate University
University of Cape Town
Iziko Planetarium Research Consortium



EVANS & SUTHERLAND

HO TUNG
VISUALIZATION
LABORATORY



Event Organizers

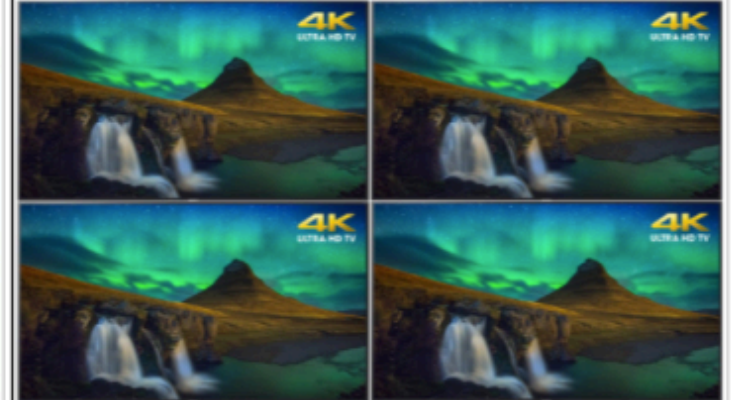
Chairs

- [Joshua Finnell](#) (Colgate University Library)
- [Joe Eakin](#) (Ho Tung Visualization Lab @ Colgate University)

2. IDIA Visual analytics Laboratory @ UCT



Virtual Reality

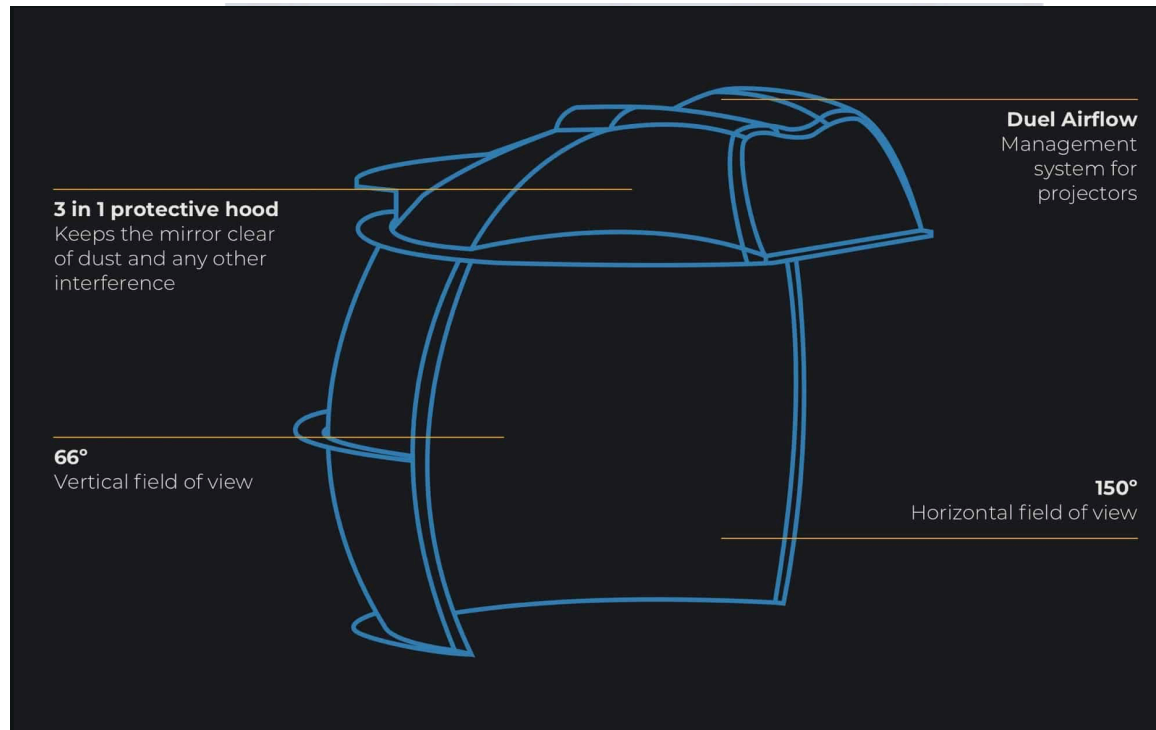


8K Wall

The COBRA

The Cobra is comprised of four components:

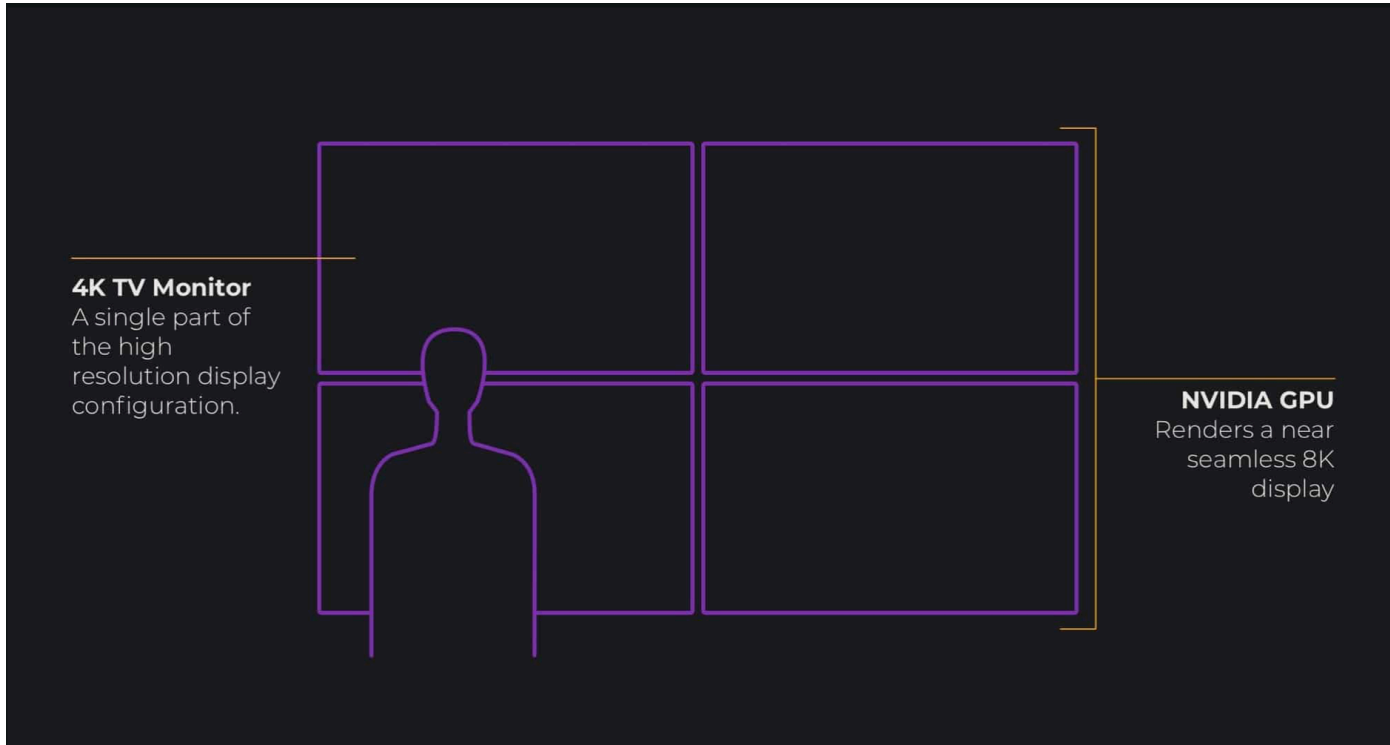
- (1) curved screen: 71 inches (180 cm) in (curved) width, and 53 inches (135 cm) in height, for an aspect ratio of 1.34.
- (2) spherical mirror
- (3) single projector: sony 4K
- (4) computer system: Window-10 computer, that is driven by a powerful NVIDIA 1080ti GPU



WALIE

The Wide Area Large Interactive Explorer

- LINUX machine
- Plug & Play



The Virtual Reality station

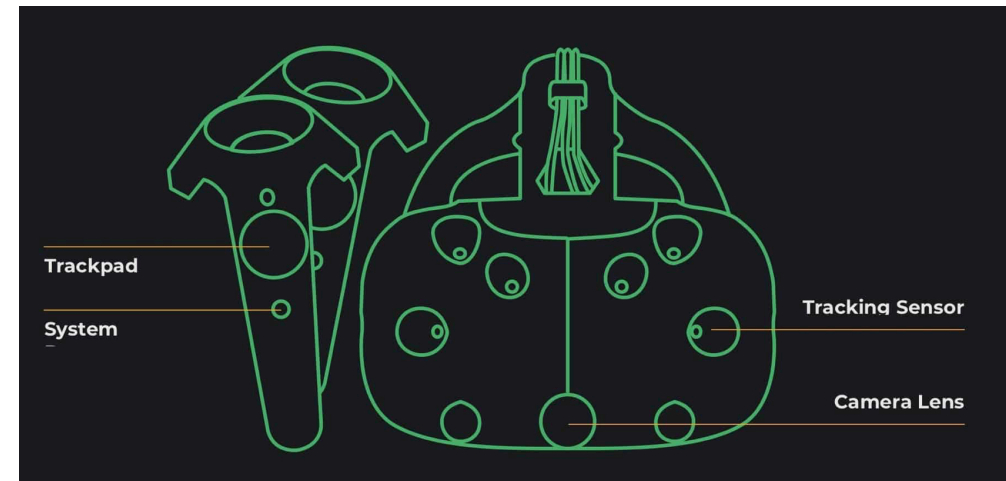
Our main toolboxes are the **Unreal Engine** (C++) and **Unity** (C#).

We use the **SteamVR plugin** (Valve Corporation) that enables the flexible use of VR headsets from multiple manufactures.

Current **hardware platforms** that have been successfully tested include **Oculus Rift** and **Rift S**, **HTC Vive** and **Vive Pro**, as well as the **Samsung Odyssey**.

The headset are controlled by a PC computer with a GPU (NVIDIA 1080Ti).

The all-important headset has an **OLED screen for each eye**, **roughly 1K in resolution** (which is not enough, 6Kx6K is desirable), refreshing at 90 Hz, and a field of view of about **110 degrees**. The paddle controllers (one for each hand) have many buttons enabling multifunctionality





iDaVIE

immersive Data Visualisation Interactive Explorer



iDaVIE software suite - See poster P4.6

Virtual Reality and Immersive Collaborative Environments: the New Frontier for Big Data Visualisation



Alexander K. Sivitilli¹, Angus Comrie^{1,2}, Lucia Marchetti¹, Thomas H. Jarrett¹

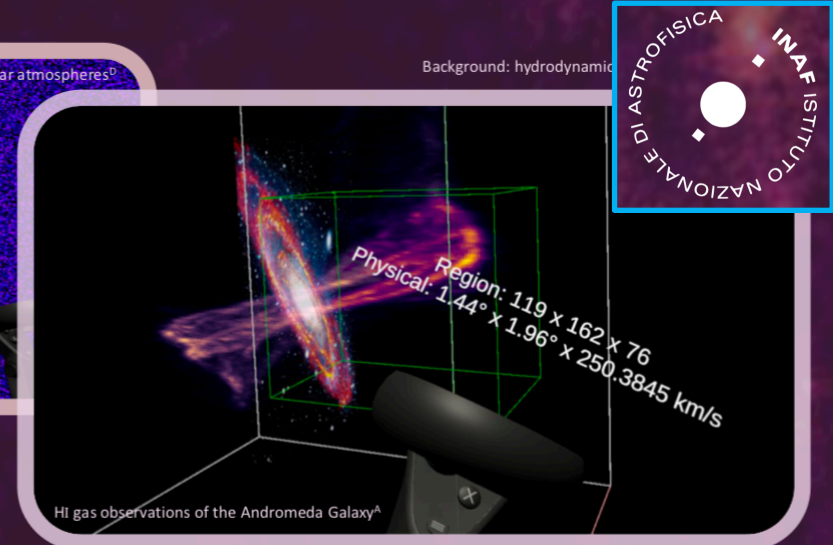
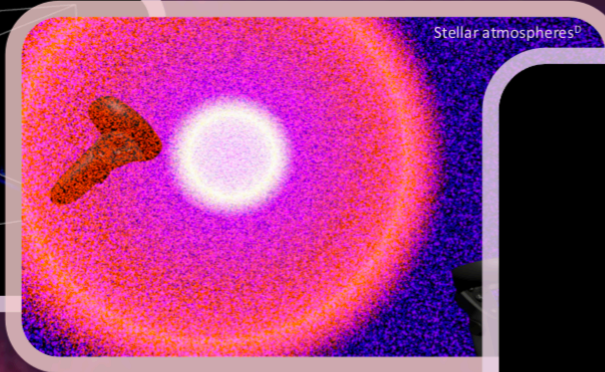
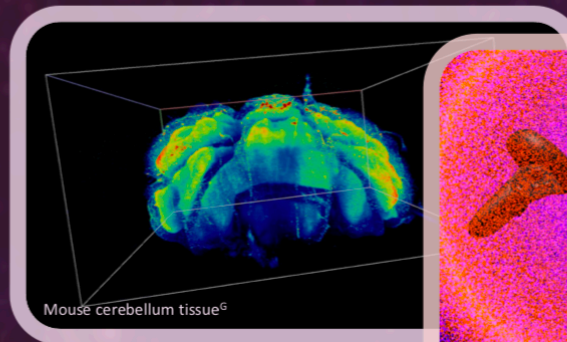
1) Department of Astronomy, University of Cape Town

2) Inter-University Institute for Data Intensive Astronomy (IDIA)



iDaVIE

immersive Data Visualisation Interactive Explorer



iDaVIE "flavors"



1. iDaVIE-c : catalogue/particle rendering

- Simulation visualization
- 3D Large scale structure investigation

2. iDaVIE-v : Volume rendering (Beta release @ PHISSC2020)

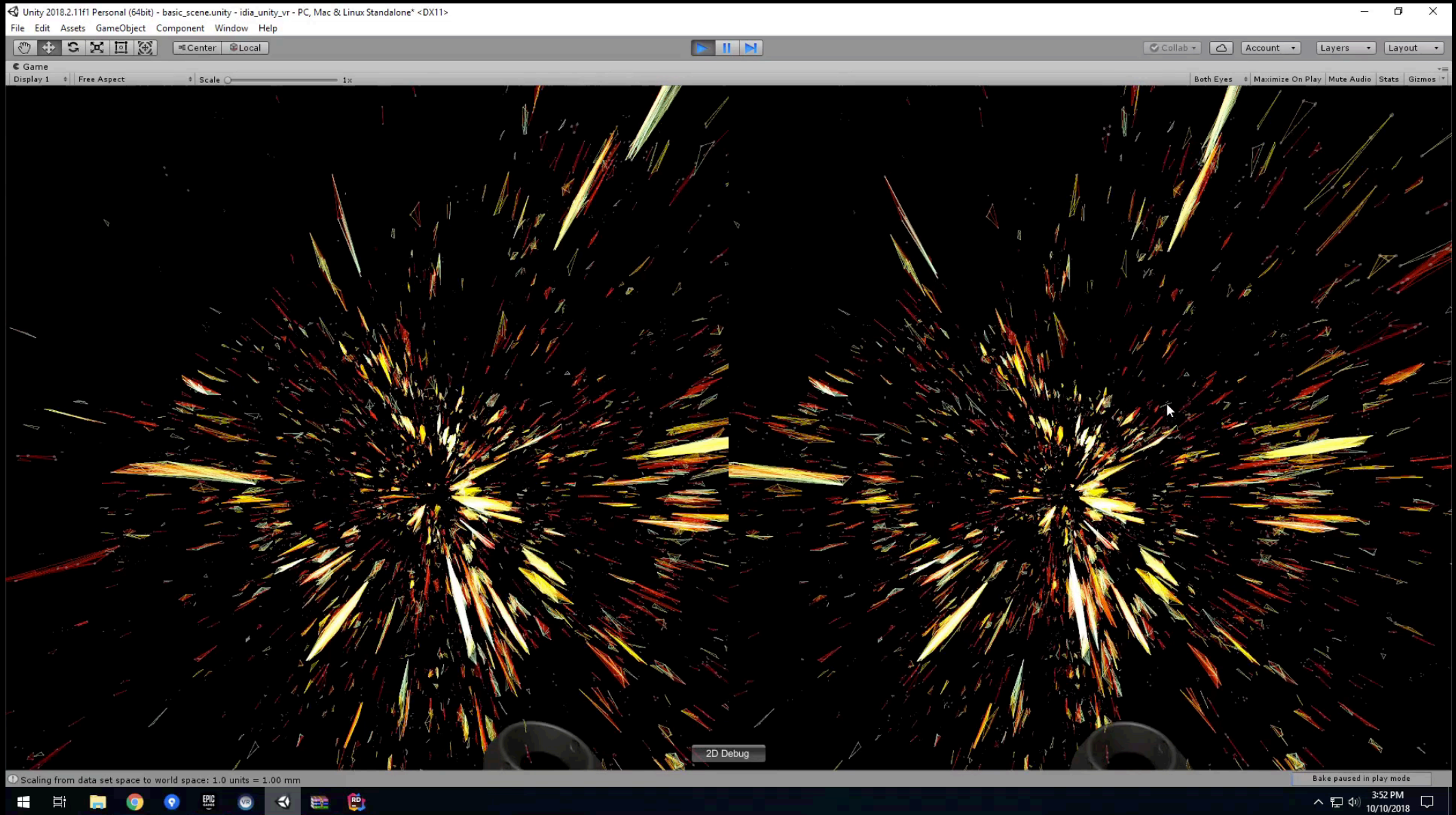
- Velocity (spectral) Cubes rendering

3. iDaVIE-d : VR in the Dome

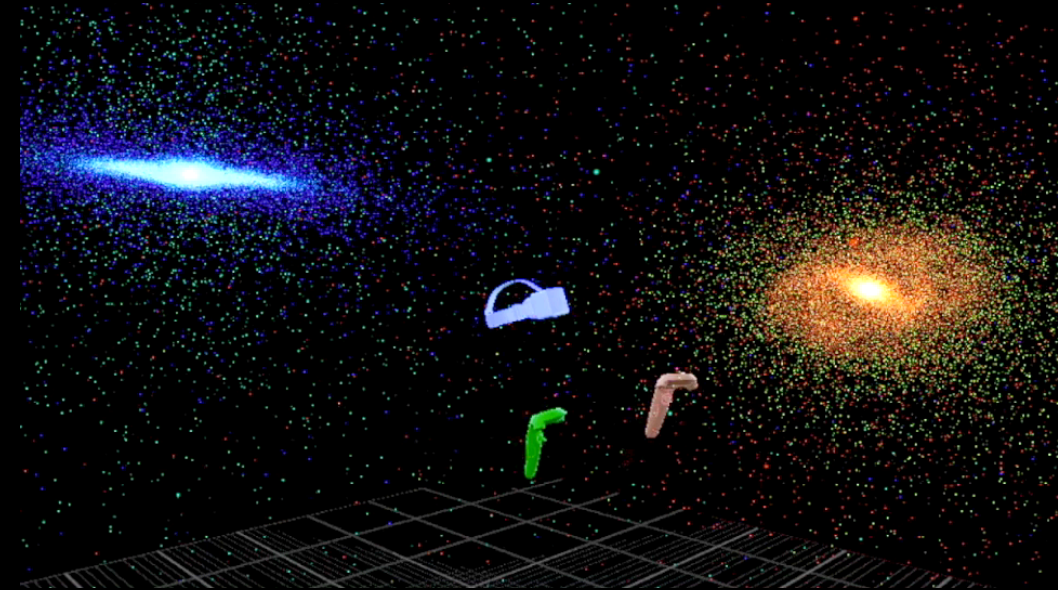
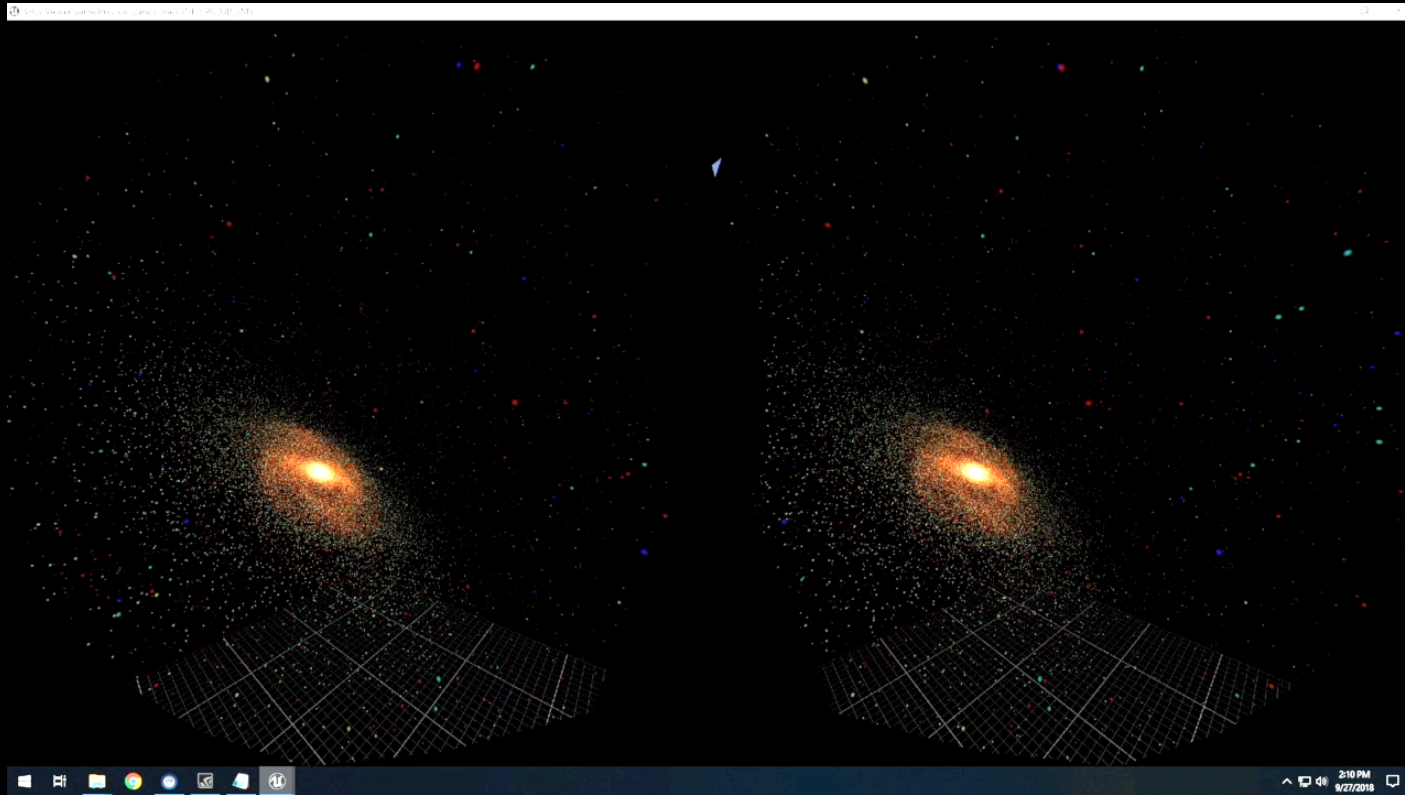


Mr Trystan Lambert (UCT - Master Student)

Graph-theory to display FoF algorithm in VR - Unity

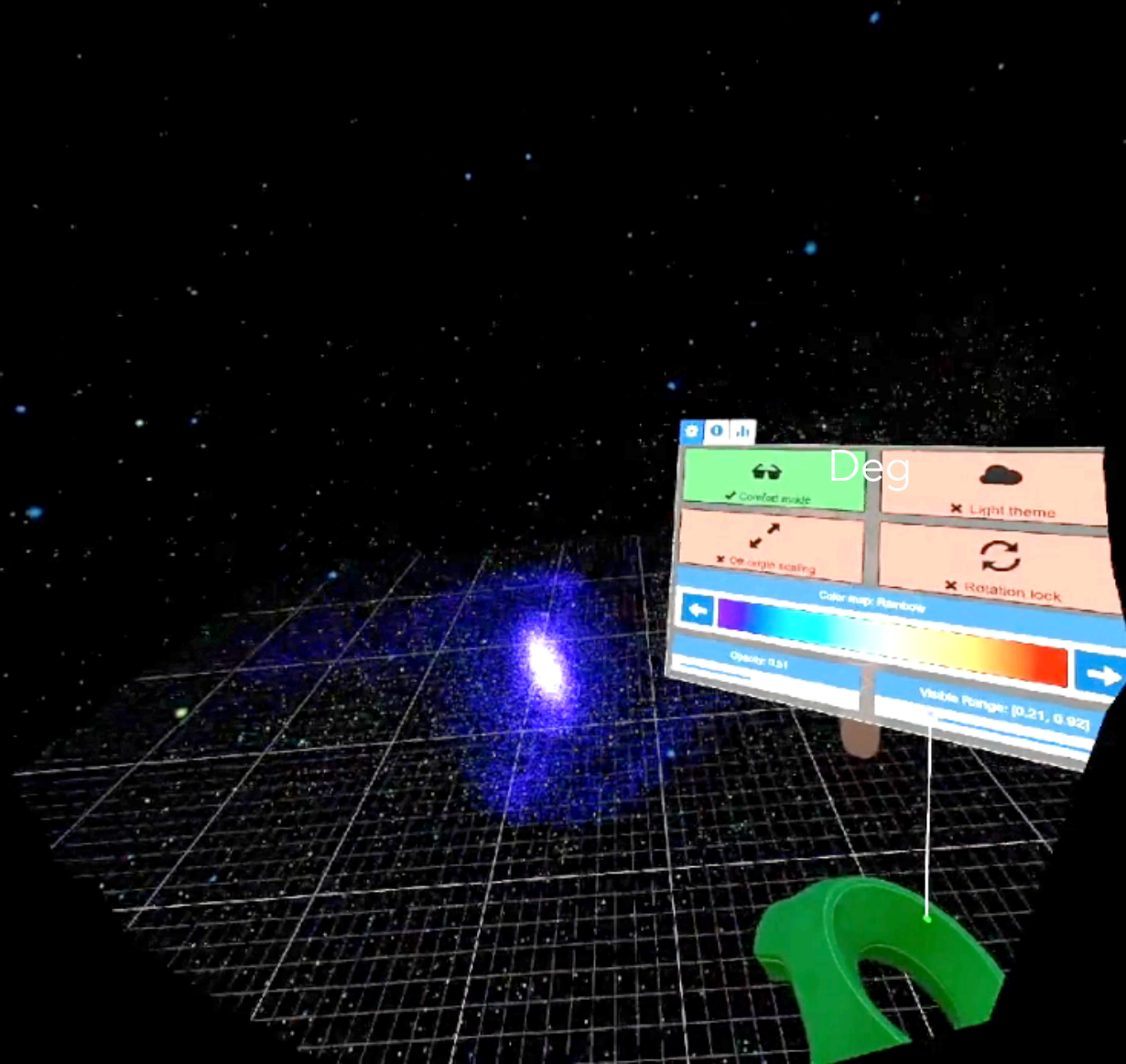


Dr Nathan Deg
Galaxy-Galaxy interaction simulation (galactICS) – Unreal Engine



Dr Nathan Deg

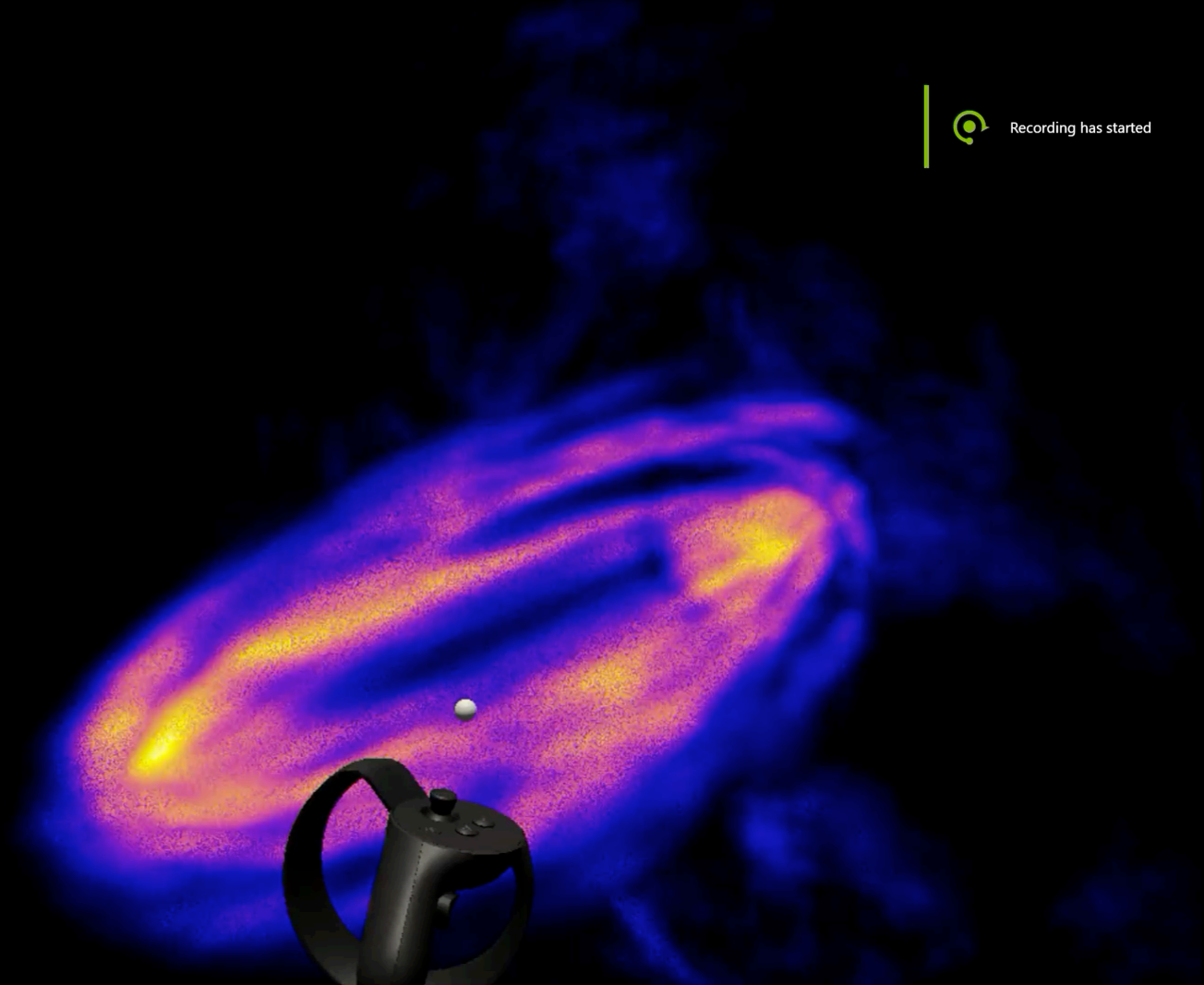
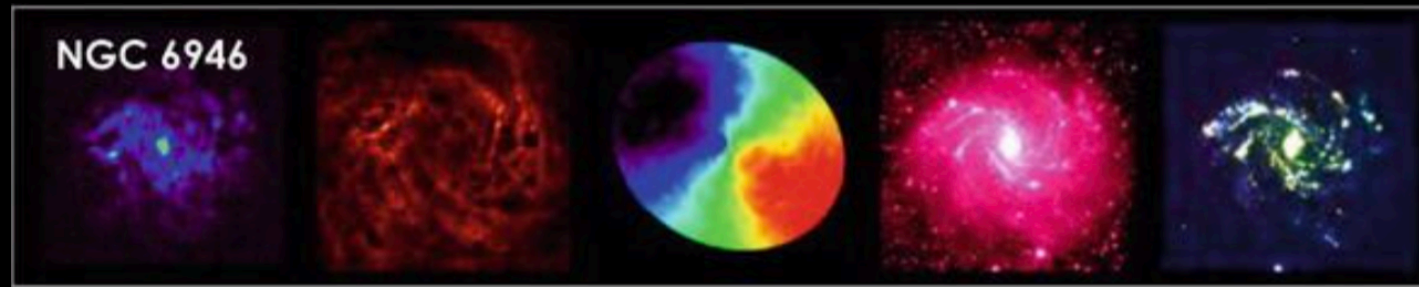
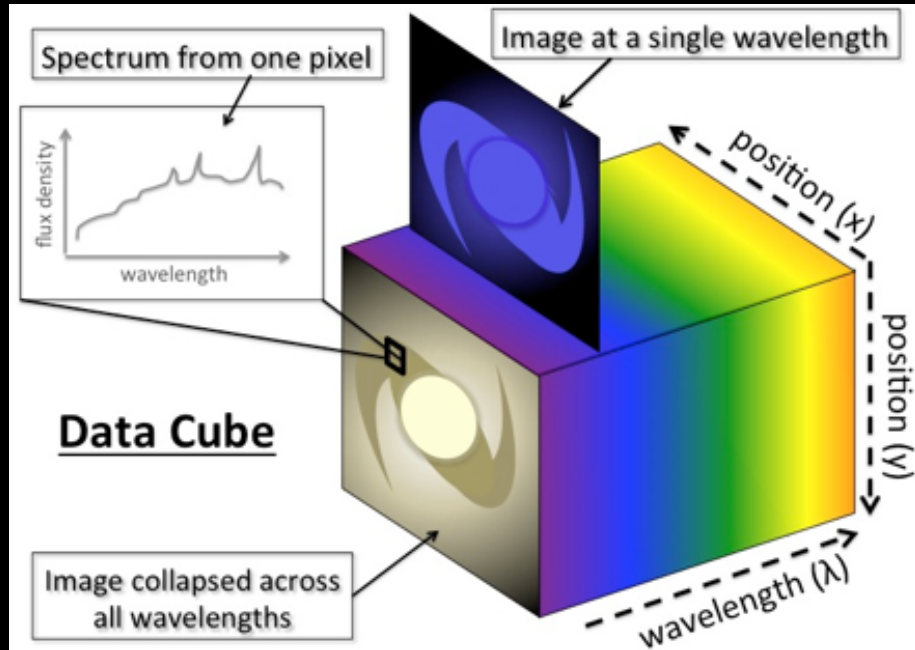
Galaxy-Galaxy interaction simulation (galactICS) – Unreal Engine



A New version of the GUI
is now under-development
in collaboration with INAF-
Catania!

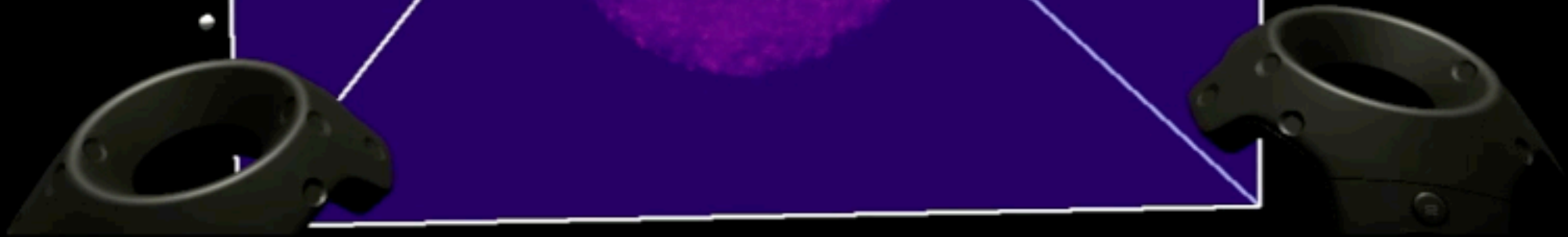


Carignan+ 1990 WRST velocity cube Unity Engine



iDaVIE

Volumetric Cube Interaction



Source Extraction

Working with Masks

The background of the slide is a deep purple astronomical image showing a dense field of stars. A large, dark, irregularly shaped region in the center is masked out. A bright yellow star is visible within this masked area, and a red rectangular box is drawn around it. A white rectangular box is also visible, partially overlapping the masked region.



Efficient Data Processing for Large Image Cube Visualisation

A. Comrie^{1, 2}, R. Simmonds^{1, 2}, A. Pinska^{1, 2}, A. R. Taylor^{1, 2, 3}

¹Inter-University Institute for Data Intensive Astronomy ²University of Cape Town ³University of the Western Cape



CARTA Software Package



The Cube Analysis and Rendering Tool for Astronomy (CARTA) is a software package for efficiently visualising large image cubes in a server-client approach. It is developed by a collaboration of developers from the four institutes shown below. Version 1.3 of CARTA will support contour overlays.

See P4-3
for details



<https://cartavis.github.io>



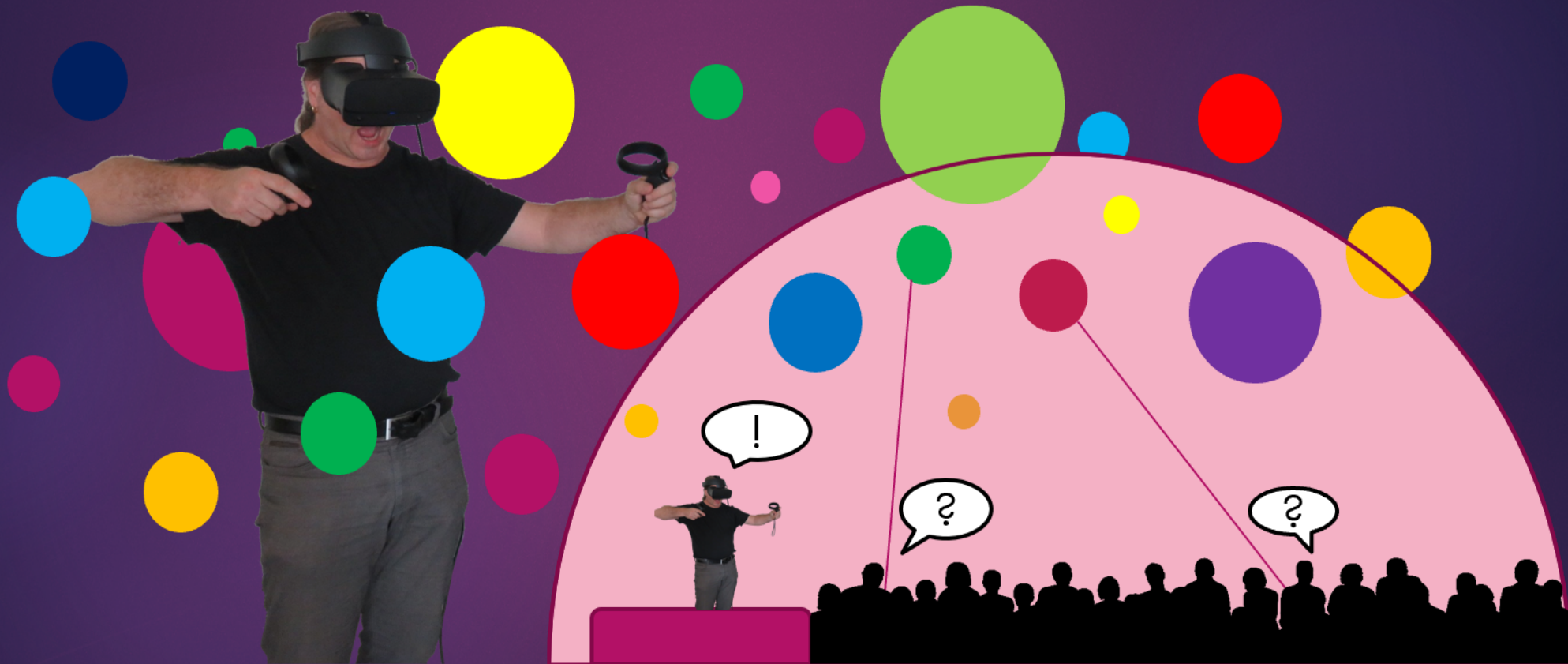
<https://github.com/CARTAVIS>



See posters P4-5 & P4-3

VR in the Dome

iDaVIE-d



Pathfinder HI Survey Coordination Committee Workshop

PHISCC 2020

11-15 May 2020, Cagliari, Italy



Beta release of iDAvie will be presented at:

Cosmic Flows Large-Scale Structure & Visualisation

A conference in celebration of Prof. Renée Kraan-Korteweg
17 - 21 February 2020, STIAS, Stellenbosch, South Africa



WE ARE HIRING!

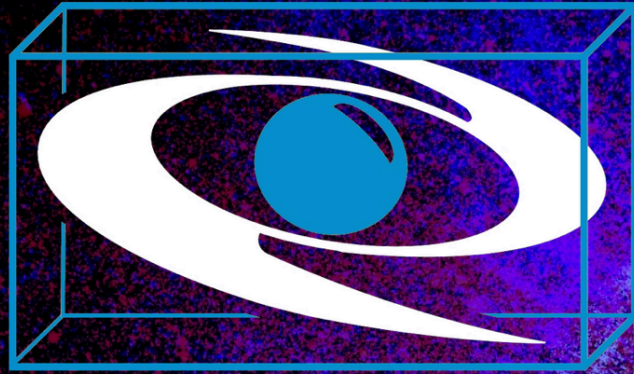
IDIA Visualization postdoctoral fellowship

Visit: idia.ac.za

Published on October 30, 2018 by carolune



vislab.idia.ac.za



IDIA

Visualisation Laboratory

IDIA | VISLAB

Research in visualisation, analysis and methods

THANKS !

@Luci_aMarchetti

