

Aesthetics in Science and Visual Arts: Visualising the Astronomical Sublime

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Differences between Science and the Arts



“Art expresses meanings, whereas science states them. A statement gives us directions for obtaining an experience, but does not supply us with experience. If science expressed the inner nature of things it would be in competition with art, but it does not. Aesthetic art, by contrast to science, constitutes an experience”. (Tom Leddy, 2019)

While agreeing that art and science are not indistinguishable from one another (in terms of the range of each field’s purposes and success criteria), this account sets up unproductive binaries between meaning and experience, and between the inner and outer nature of things.

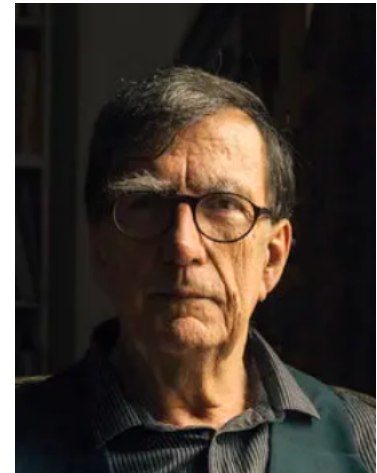


Alignments between Science and the Arts



Both fields view reality as incomplete, and in need of extension. Both aim to create new realities rather than capture pre-existing ones, by constructing representations of the properties, processes, and interactions of materials, phenomena and human agents.

Neither area aims to copy nature. Scientists make claims about how nature works. Artists makes claims about our learnt perceptions of nature, how our physiology registers or could register our experience of the world (Bruno Latour, 2014).



Overview of Presentation



1. What is meant by aesthetics in general, and in visual arts and science in particular?
2. Why and how has an arts aesthetic productively informed astronomy research and representation?
3. What's next in these synergies?

Two Broad Meanings of Aesthetics

Wickman (2006)



1. Aesthetics as design practices, disciplined ways of focusing, framing and proceeding in research, approved approaches, accepted ways to inquire and problem-solve in a domain. Subjects have a recognizable aesthetic, including astronomy.

2. Aesthetics as cultivated feelings, learnt affective responses to the practices above (in contrast with everyday aesthetic responses).

Scandinavian Design Aesthetic



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The Aesthetic of Arts and Science



Aesthetic as practices in the Arts

Making the familiar strange and mysterious, transgression, playfulness, unruliness, relinquishing conscious control, practice before theory, realizing concepts through objects, disruption, novelty, repurposing of throwaway materials, pattern-spotting and pattern-making, ephemerality, assemblage, shock, pleasure in distortion, mesmerizing through the beautiful, inscrutability, ineffability, wonder, realism, the sublime

Traditional aesthetic as practices in the Sciences

Parsimony and elegance of expression/theory, trust in the instruments, search for pattern, appreciation of objects and methods of science, precision, wonder, beauty, realism (Chandrasekhar, 1987)

Anxiety about bias, subjectivity, distortion, inaccuracy and implausibility, strong epistemic vigilance (Daston, 2007)

Why and how has an arts aesthetic productively informed astronomy research and representation?



1. Creative transduction for new meaning-making
2. Extending the sublime
3. Broadening of research perspectives, questions, foci, methods, representation
4. Aesthetic, expressive, affective, imaginative input into scientific problem-solving and communication

“Transduction” (Kress, 2000, Volkwyn, Airey, Gregorcic, & Heijkenkjöld, 2016) is the imaginative process whereby we remake meaning of a sign in one mode into a sign in a different mode.

Turning data into images is transduction (the aesthetic of astronomy).

Turning feelings into words is transduction (aesthetic responses to astronomical challenges and images)



Aesthetic responses as transduction

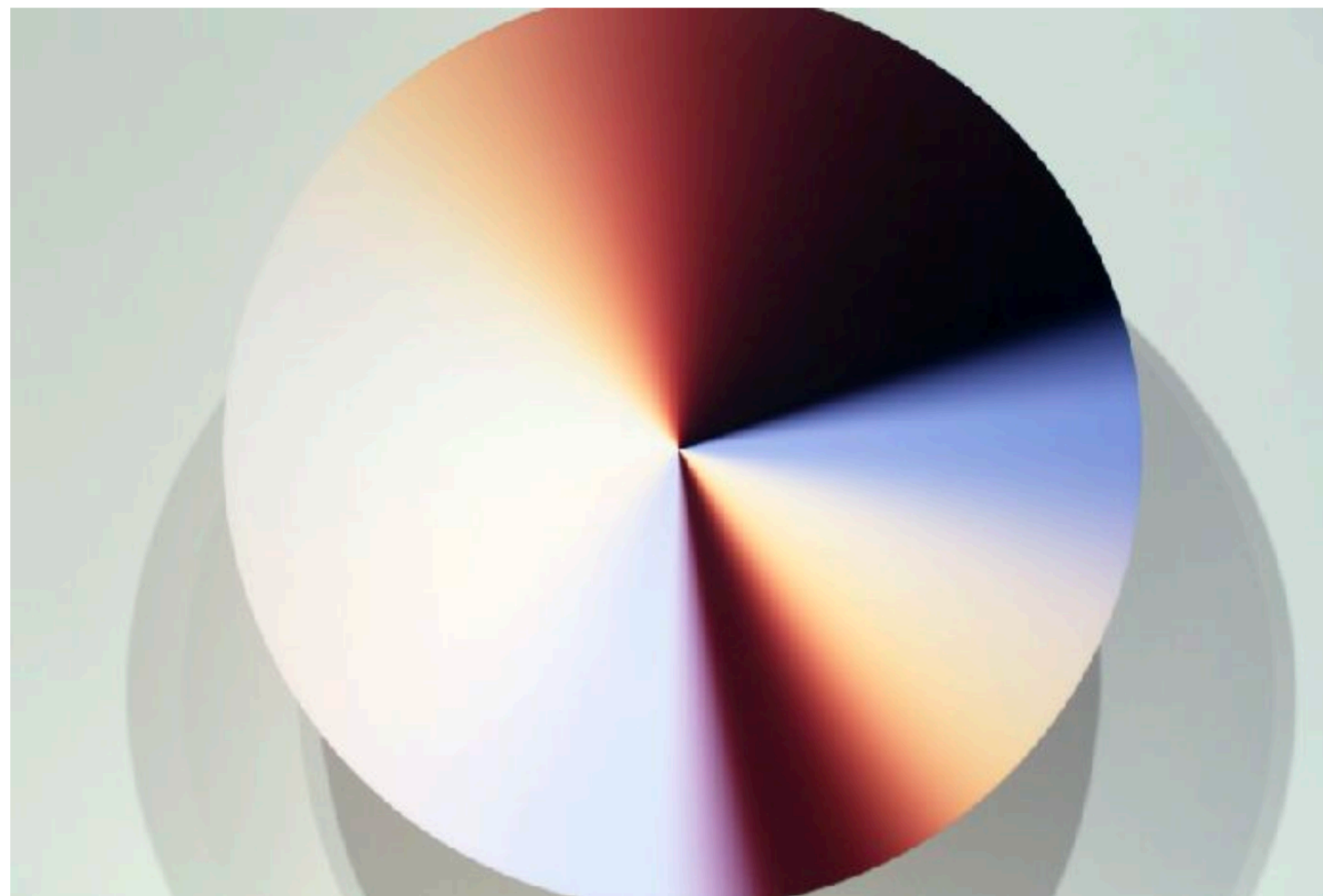


Most feelings are “too specific for words”. It is only when we represent them to ourselves in the terms of verbal language, or classify them as belonging to some class of culturally familiar, if not nameable, feelings that we get the sorts of feeling-types that are commonly referred to (and culturally-specific). (Lemke, 2015, p. 603)

Verbalised aesthetic feelings include awe, wonder, the sublime, absorption (flow), disappointment, delight, surprise, anticipation, frustration, effortfulness, dismay, pleasure, puzzlement.

These local responses build to a subject aesthetic of learnt feelings, including a passion, liking or taste for this subject, for its experience as pleasurable.

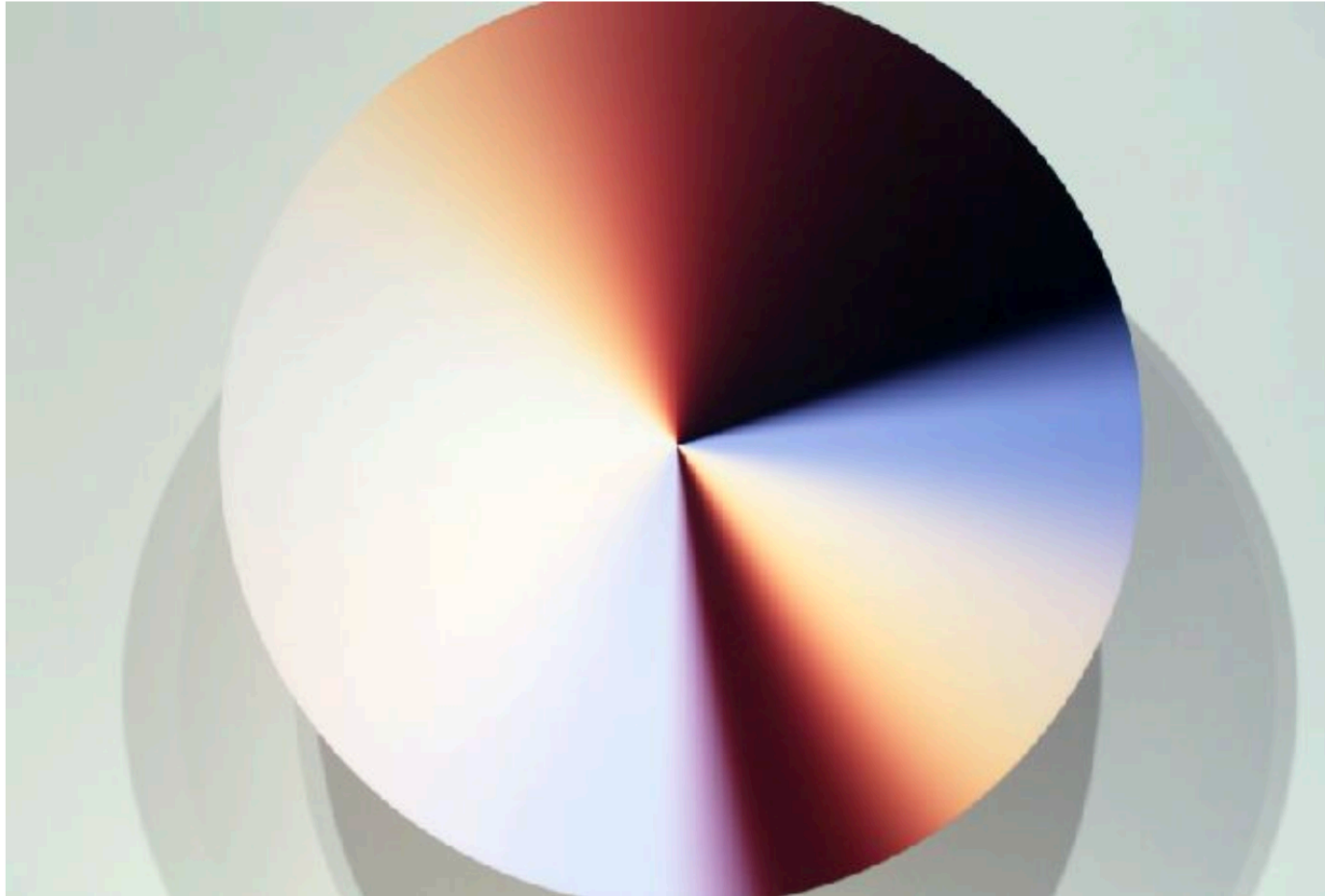




The Cosmic Spectrum by Katie Paterson PIC: Manu Palomeque



Colour of the Universe



The Cosmic Spectrum by Katie Paterson PIC: Manu Palomeque



Colours of the Universe

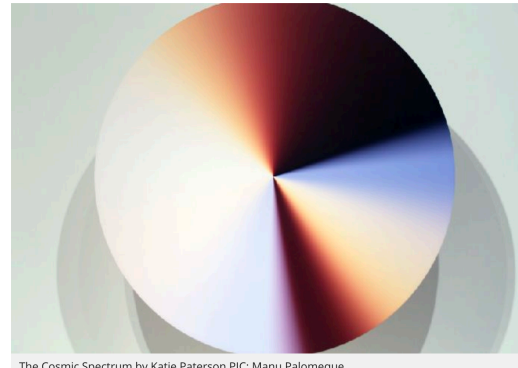
Katie Paterson (2019)



Paterson worked with scientists to establish the colours visible to the naked eye during the ages of the earth, from the blinding light of the Big Bang to the beige of our current Stelliferous Era (christened “cosmic latte”) and the darkness which will end all darkness, some 100 trillion years hence. As it spins, it repeats the cycle of billions of years, each revolution in the blink of an eye.

“Sky blue gives way to deep, dark red, and the present era – the era of the stars “cosmic latte”. Then it continues through orange, as the stars die, to reach absolute darkness, when all the stars have burned out and even all the black holes have evaporated. We’re still working on it. We haven’t got the final deep orange of the end of the universe. There’s a bit of talk about whether it’s a very reddy orange...”

Paterson 2019



The Cosmic Spectrum by Katie Paterson PIC: Manu Palomeque

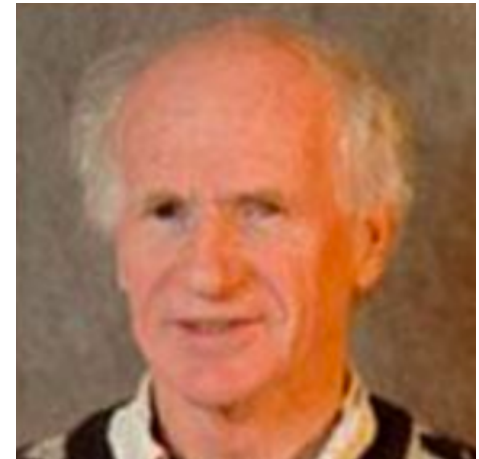
Imagination and Visualisation



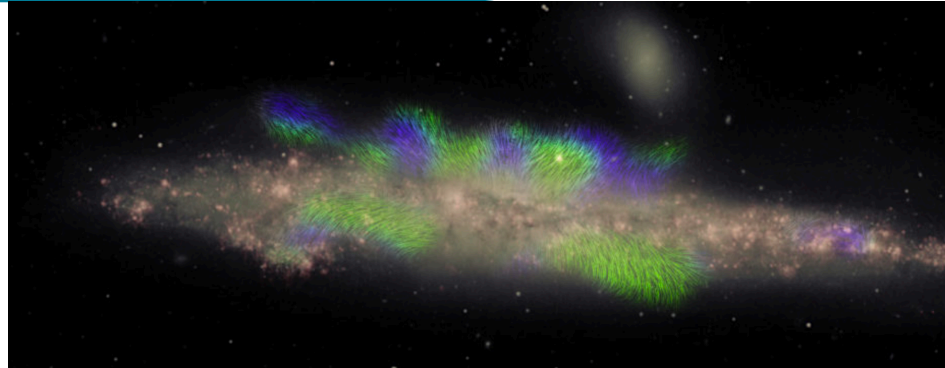
“The whole question of imagination in science is often misunderstood by people in other disciplines. They overlook the fact that whatever we are *allowed* to imagine in science must be *consistent with everything else we know* ... We can't allow ourselves to seriously imagine things which are obviously in contradiction to the known laws of nature. And so our kind of imagination is quite a difficult game.” Feynman, Leighton and Sands (1963-5)



“We are a little bit like the blind men and the elephant, since each time we look at the galaxy in a different way we reach a different conclusion about its nature!”
Richard Henriksen, 26/11/2019



Giant Magnetic Ropes in a Galaxy's Halo



However, we seem to have one of those rare occasions where a classical theory, about magnetic generators called dynamos, predicted the observations quite well. Our dynamo model produces spiralling magnetic fields in the halo that are a continuation of the normal spiral arms in the galaxy's disc.

Richard Henriksen (2019)



"The Sublime is not strictly speaking something which is proven or demonstrated, but a marvel, which seizes one, strikes one, and makes one feel." Boileau, 1674 (trans Longinus)

Key attributes of the sublime include vastness, unknowability, variety and death

Aesthetic feelings for the sublime include astonishment (Burke, 1757) agitation and stimulus to inspire/reason/explain (Kant, 1790)

A sense of infinity and emptiness, of being overwhelmed, contemplative serenity, awe, terror and boundlessness, transcendence, exaltation with spiritual connotations, appreciation.

Astronomical sublime as a Kantian knowledge-making narrative, disruption of stable coordinates of space and time, immensity, infinity, and human potential.



Black Hole Image



40 billion km across, three million times Earth's size

500 million trillion km away and photographed by network of eight telescopes

A mass 6.5 billion times that of the Sun. "One of the heaviest black holes that we think exists. It is an absolute monster, the heavyweight champion of black holes in the Universe." Falcke (2019)



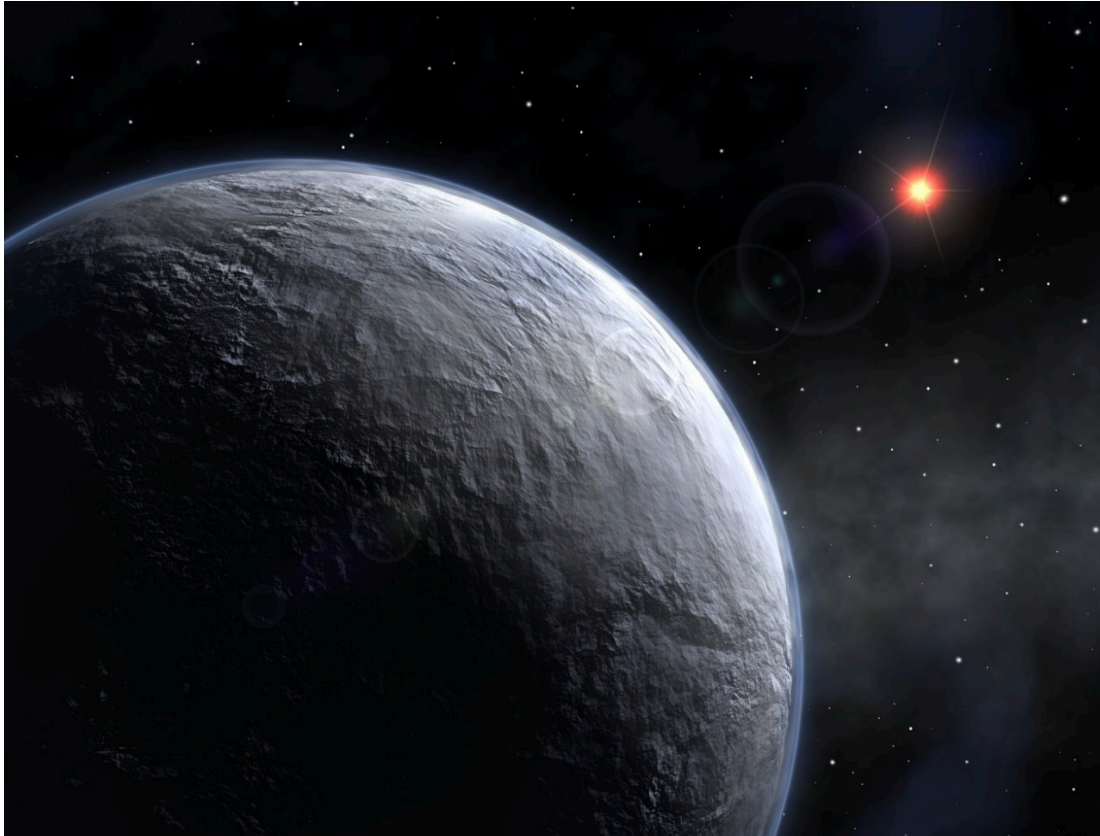
“the visual language of the sublime is a tension between the senses and reason” and “an extreme aesthetic experience, one that threatens to overwhelm even as it affirms humanity’s potential.” Elizabeth Kessler (2012)

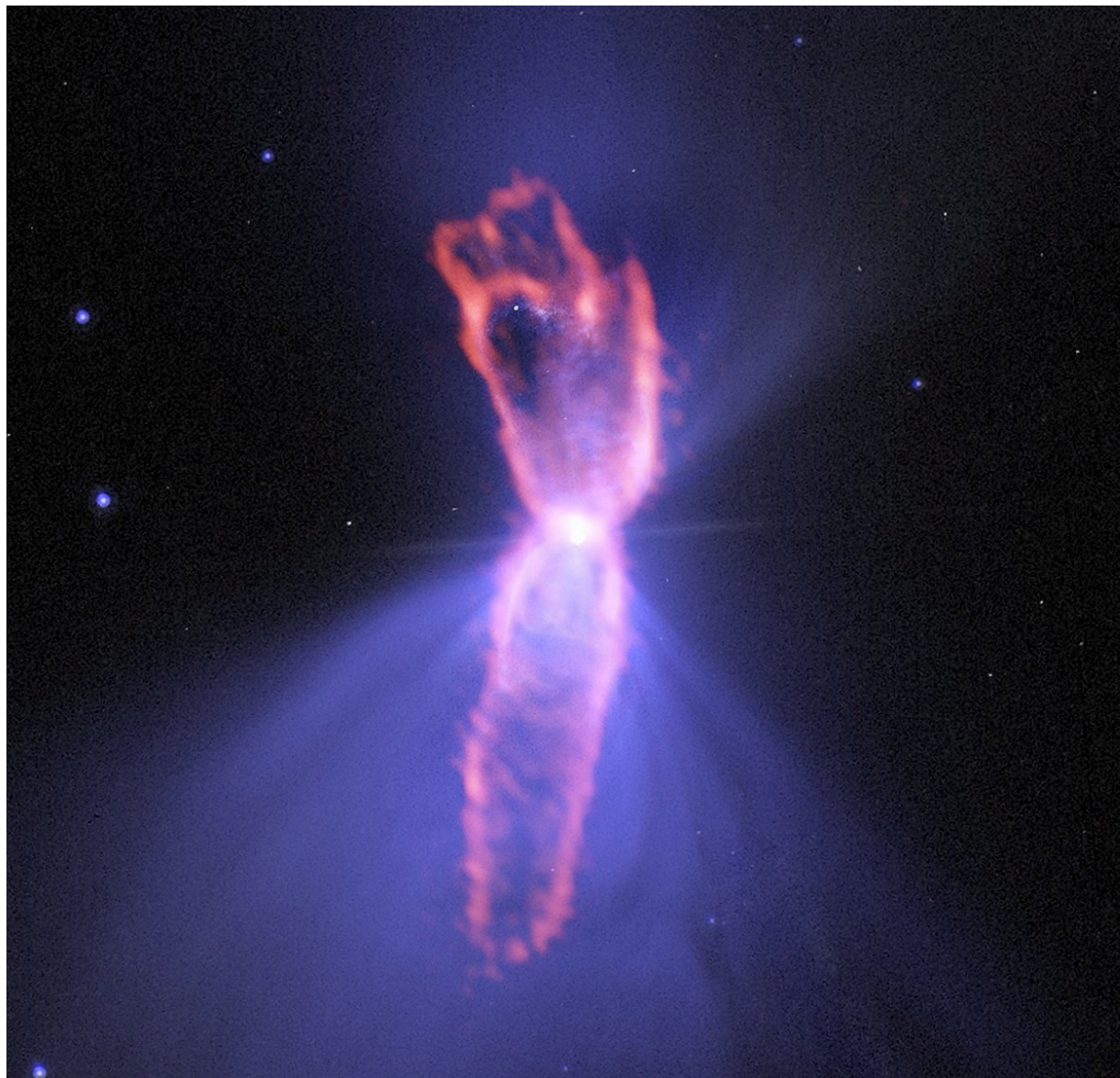


“Applying the techniques from art definitely influences the way astronomers see and interact with their data. I don’t think [techniques from art] in astronomy visualization can be relegated to a sidebar any longer. It really does enhance discovery science.” Jayanne English (2019)

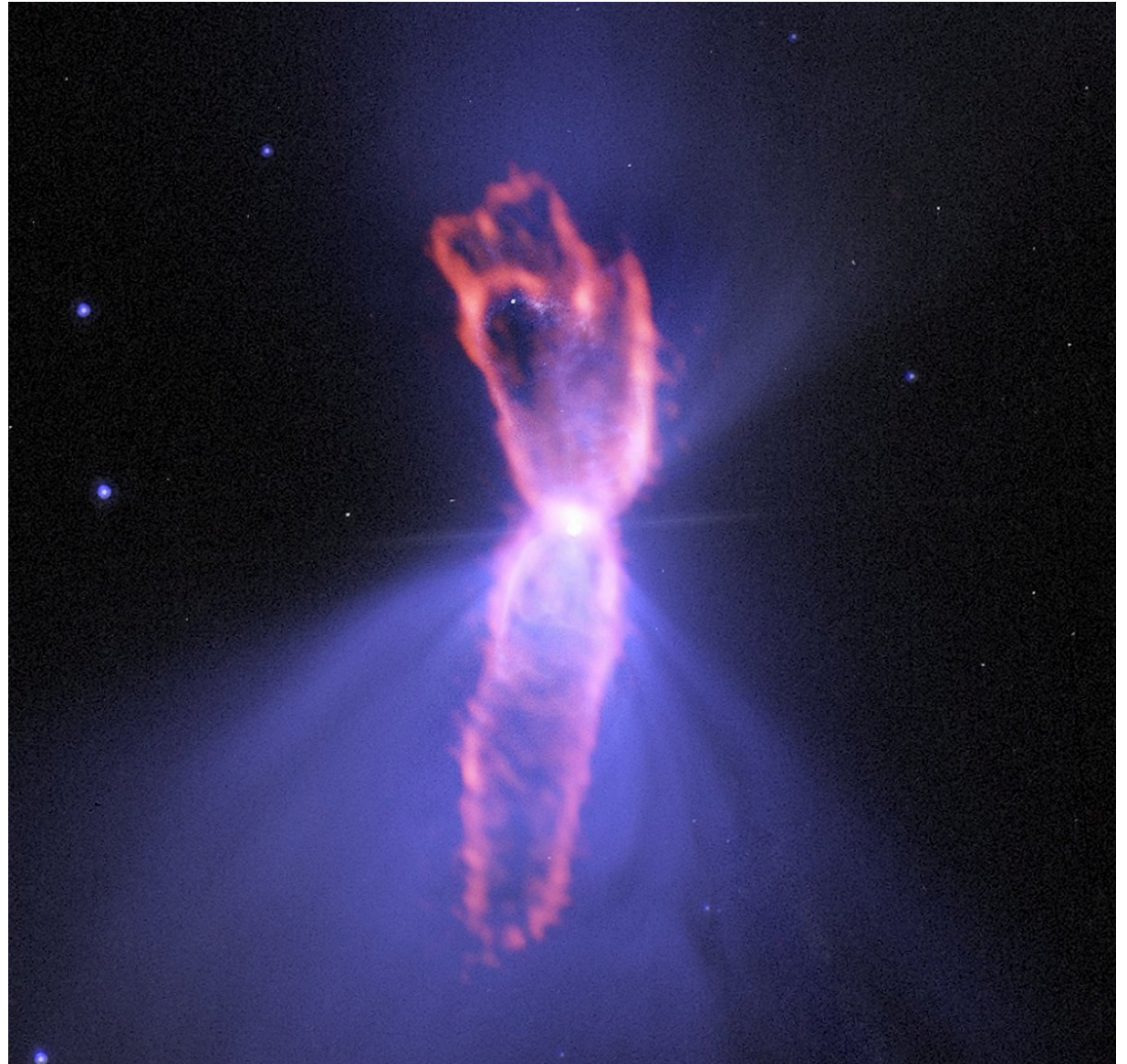




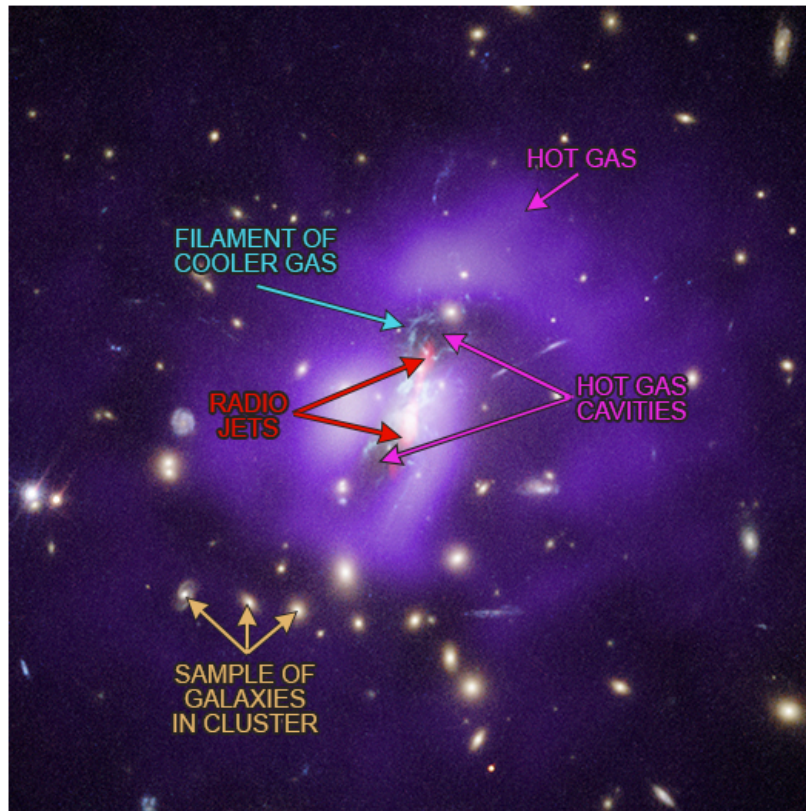




Coldest known object in Universe: Nebula located about 5000 light-years from Earth



Annotating the Sublime: A Weakened Black Hole



Hot gas, radio jets, and star formation in a galaxy cluster

Combined X-ray, optical and radio image reveals the mechanism allowing rapid star formation at the core of the Phoenix Cluster of galaxies.

Credit: X-ray: NASA/CXC/MIT/M.McDonald et al; Radio: NRAO/AUI/NSF; Optical: NASA/STScI.

Contribution of Arts to Astronomy



1. Creative transduction for new meaning-making
2. Extending the sublime
3. Broader research perspectives, questions, foci
4. Aesthetic, expressive, affective input into scientific problem-solving and communication,
5. Confluence of purposes (create new realities) away from traditional cloistered aesthetic of traditional science.

What's next?



Projects include:

SETI sending science/arts-based signals to the Universe 2020

Symmetry. Roundtable in Chile 2020 Arts at CERN, ALMA, ESO, the Chilean Corporation of Video and Electronic Arts, the New Media Area of the Chilean Ministry of Culture, Arts and Heritage, and the United Nations Educational, Scientific and Cultural Organization (UNESCO).

Implications for Teaching Cosmology in School



Teacher needs to focus on both senses of aesthetics, as a disciplined set of ways to inquire, and also to elicit students' aesthetic feelings about inquiry in this subject.

Teacher needs to treat aesthetic feelings and judgments as contextual facts that shape student actions and intentions.

Aesthetic judgments promoted by teachers and activity can become part of doing science.

Students need to imagine/visually represent emerging understandings of origins, entities and systems in the cosmos, and participate in transduction, turning data into annotated visual accounts/explanations.

School-based inquiry should parallel astronomer purposes, methods, and ways to test and refine knowledge-building.