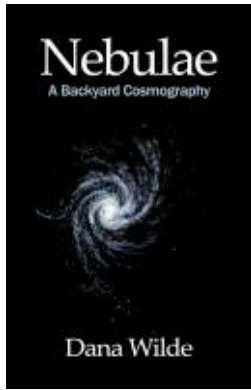


Nebulae

A Backyard Cosmography



Dana Wilde



Nebulae: A Backyard Cosmography peers into the vast elsewheres of the planets, stars and galaxies, bringing astronomical facts into focus with everyday experience. These writings provide accessible, entertaining, and thought-provoking interfaces between the commonplace and the cosmos.

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Nebulae: A Backyard Cosmography

On *Nebulae*:

"Dana Wilde has a scientist's curiosity and a poet's imagination. I can think of no other writer who would describe our galaxy as being 'just a blur, like a wisp of spit in a lake.' This man has star marrow in his bones. Pay attention."

Tom Sexton,
Poet Laureate of Alaska (1995-2000)
and author of For the Sake of the Light

On *The Other End of the Driveway*:

"Wilde is unwilling to just accept the conventional answers provided in most naturalists' guides. He presses issues from scientific and philosophical points of view; he asks tough questions – really tough questions. He delves into the universe, be it measuring starlight, time or even creation. While those answers could be lofty and ethereal, Wilde has done his research – sometimes incorporating very difficult concepts about universe, time and natural laws – so that he can explain them with surprising ease."

Steven M. Pappas,
Barre-Montpelier Times Argus

On *Ursa Major: Essays in Outer Space*:

"Dana Wilde writes with relaxed skill and quietly resourceful information. ... These essays take a well-earned place with all such human reflection and conjecture, from Lucretius to Thoreau and onward ... bridging between two patterns of [scientific and everyday] human 'worlds.'"

Robert Creeley
August 2000

“... by the term ‘Universe,’ wherever employed without qualification in this essay, I mean to designate *the utmost conceivable expanse of space, with all things, spiritual and material, that can be imagined to exist within the compass of that expanse.*”

– E.A. Poe, *Eureka: A Prose Poem*

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2012

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EUROPA

Jupiter's moon Europa is covered with ice.

It's kind of unsettling to think about out there, circling silently around the giant planet in the middle of magnetic- and gravity-ridden space. It's white and almost as smooth as a cue ball. The ridges, pits, cracks and grooves in the ice rise and descend no more than a few hundred yards, which is about the terrain you'd find if you expanded the cue ball to just less than the size of our own Moon.

There is also a thin atmosphere of mostly oxygen, odd for a moon, or anywhere actually. It's thought to be formed from sunlight striking water molecules and splitting them into their two atoms of hydrogen, which is light and drifts away, and oxygen, which is heavier and stays. The unusualness of this is not the gases as much as it is the water that gives rise to them: Europa's ice shell is estimated to be fifty to one hundred miles deep, and underneath that is believed to be a liquid ocean.

An ocean beyond Earth? Apparently so, according to the findings of the Galileo spacecraft which orbited Jupiter in the late 1990s. The warmth that keeps the water liquid is generated through "tidal heating." The whole moon is twisted and flexed by the interacting gravity fields of Jupiter (whose gravitation is so big it keeps Saturn in line) and its other large moons Callisto, Ganymede and Io, and the twisting creates heat deep inside. Evidence of the heat are flows of ice on Europa's surface, not liquid rivers but ice that emerges from inside which is warmer than the dead-cold surface temperature of -260 degrees Fahrenheit.

There is a lot of scientific excitement about what that warmth might imply about Europa's underworld. If its inner ocean is

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indeed liquid then it's reasonable to wonder if life could have sparked and evolved in there. How anything could live in total darkness under ice fifty miles thick, no one is sure. But "extremophiles" – creatures living in environments fatal to the rest of us – have been found in very unlikely spots here on Earth, like in near-boiling water, in radiation that would kill a human, and in ice. Recently some NASA researchers drilled a hole in the Antarctic ice sheet and stuck a video camera down there to see what was going on with the water, when a three-inch-long shrimplike creature muddled onto the camera. It lives there under the ice. If things can evolve so they live under Antarctic ice, then living things might be evolving inside Europa.

These are just the cold, hard facts as the astronomers give them. Cold up to the point, anyway, where the possibility of something living inside Europa twists up your imagination and different kinds of fact-based excitement start bubbling into thoughts.

Wandering reflections on the possibilities of extraterrestrial life are fascinating, but can get kind of unsettling. Recently the eminent physicist Stephen Hawking warned that searching for intelligent extraterrestrial beings is risky because if they exist, they might not be friendly. So far, nobody thinks that any possible European beings are intelligent in our way of defining the word. If they exist, they're more like those shrimpisms, or much smaller. But really, how do we have any clue what's evolving under that ice? What unthinkable things right now, this exact moment, are twisting, furling and muckling in that frigid blackness?

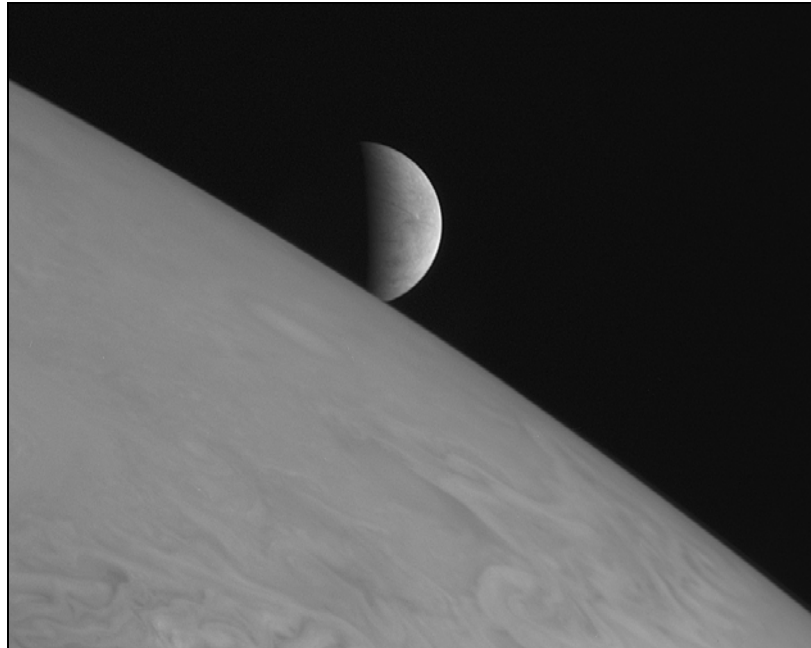
An ice age ago back in college, I was transfixed for a while by the word "eldritch." I discovered it in H.P. Lovecraft's horror stories. It means "eerie" in the sense of unearthly, and might have evolved from an Old English expression we'd translate as

“elf-rich” or “elf-realm,” with a relation to the prefix al- which indicates “beyond,” then transmuted itself through Scottish back into modern English. In his story “At the Mountains of Madness,” Lovecraft’s scientists go on an expedition to Antarctica and deep inside the continent they discover the ancient ruins of inhabitants from beyond Earth. Eldritch beings live there in the ice. Something wicked that way went.

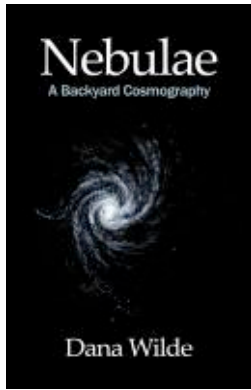
Anyway, these are just thoughts wandering off and twisting around in the dark. We don’t know what’s out there in that cold.

We do know there are oceans within worlds. Not only Europa, but Ganymede and Callisto are thought to have subsurface seas, and also Saturn’s moons Enceladus and Titan. They are all far, far away, circling around and around those huge planets in space that seems empty. It certainly seems like it’s empty, just as Jupiter’s moons and Antarctica did until recently. No wolves are howling on Europa, just silent, smooth, restless ice.

There are worlds within worlds, or so it has been observed for countless eons.



Europa over a limb of Jupiter.



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