The sounds of spirals

Like giant pinwheels, spiral galaxies feature curving arms that rotate around a dense core. The arms of starlit gas and dust are believed to arise when a chance gravitational impulse—the tug of a nearby galaxy, for example—triggers a wave of compression that travels around the galaxy. This disturbance is known as a density wave because it draws material together by gravitational attraction. The galaxy's rotation twists the wave into a spiral shape.

Gas caught in the spiral arms is slowed and squeezed. As a result, the arms become a hotbed of glowing gas bejeweled by bright, newly formed stars.

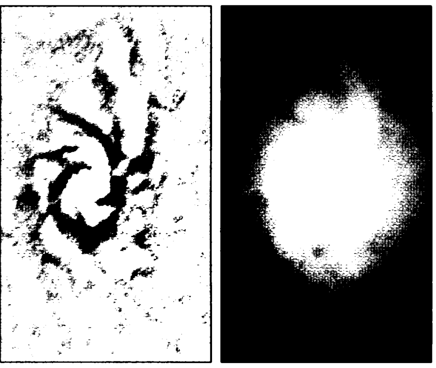
That's why the network of spiral arms recently discovered at the core of the spiral galaxy NGC 2207 caught astronomers completely by surprise. Imaged by the Hubble Space Telescope when it zoomed in on the galaxy's center, these arms do not contain clutches of newborn stars. Moreover, the arms are shorter, less curved, and in greater number than the classic spiral arms imprinted over the outer regions of the galaxy.

The gas near the galaxy's nucleus is too diffuse for a density wave to have sculpted the spiral network, says Bruce G. Elmegreen of IBM's T.J. Watson Research Center in Yorktown Heights, N.Y. Instead, he and his collaborators assert, another type of wave—a sound wave—is the most likely source of the core's pinwheel pattern. In a sound wave, pressure rather than gravity pushes matter together.

Random noise, from a source that could be as mundane as the jostling of stars and gas, would tend to be amplified by the highly curved shape of the galaxy's core, the researchers argue in the Aug. 20 ASTROPHYSICAL JOURNAL LETTERS. Because the speed of material orbiting near the core is at most only a few times higher than the speed of sound, acoustic waves could push gas and dust around with relative ease, Elmegreen and his colleagues note.

He calculates that the wave has an extremely low frequency, about 10^{-14} cycles per second, roughly 56 octaves below middle C. Even if human ears were sensitive to such a tone, its volume would be inaudible—an estimated 65 decibels fainter than the quietest sound a person can hear, Elmegreen adds.

He notes that sound waves may play a role in shaping dust lanes near the center of galaxies far more active than NGC 2207. Amid the fireworks generated by central black holes and quasars in such galaxies, however, the gentle pressure exerted by acoustic waves may be much more difficult to identify. —R.C.



Elmegreen et al./NASA

Left: Visible-light image highlights the spiral arms, which lie within 1,000 light-years of the galaxy's center. Right: Composite visible-light and near-infrared image of the nucleus of the galaxy NGC 2207, which is about 115 million light-years from Earth.

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also carbonaceous chondrites contain 40 to 200 nm balls that resemble coccoids, staphylococcus, and streptococcus on Earth. One may question our interpretation that these were nannobacteria once living in extraterrestrial space, but one cannot question the very existence of these minute objects. This is legitimate science: first you discover what's there, then you investigate further. It is amazing what you see when you start looking.

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Oily sunscreen

Regarding "What was life's first sunblock?" (SN: 7/11/98, p. 31), you attribute an argument to Miller and Cleaves that many compounds in the ocean could have provided ultraviolet protection for the building blocks of life, including "a worldwide slick of naturally produced oil." Where would this oil slick have come from? I thought oil was a product of life, the geologic fermentation of plants, and was produced much later in Earth's history.

Steve Tomasko
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Some researchers have theorized that an oil slick covering the early oceans to a depth of 1 to 10 meters could have been produced by photopolymerization of methane or by hydrocarbons delivered by meteorites.
—J. Brainard