

3-D NASA animation displays a surface pit eroded by stars in the Orion nebula

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When professor Frank Israel graduated at Leiden Observatory some forty years ago, little did he know that one of his theories would be making headlines in 2018—in the form of a 3-D animation on the Internet, no less.

Even before his graduation, Israel became interested in the significant and mysterious difference in velocity of the stars in the heart of the Orion [nebula](#) and the gases that surround them. For his doctoral research, he studied luminous gaseous nebulae, including the Orion nebula, as seen in wavelengths in the radio part of the light spectrum (measured with the radio telescope in Westerbork, the Netherlands). Many of these nebulae came in a form inexplicable by the theories of the time: asymmetrical and with an uneven, uncentered distribution of stars.

In the year leading up to Israel's promotion, radiation emanated by carbon monoxide molecules could be measured for the very first time; the presence of this radiation proved the existence of enormous, solid and largely invisible [clouds](#) of molecular gas and dust. Inspired by two publications that described the Orion nebula as a number of gases flowing along the surface of such a cloud, Israel measured the properties of several dozen similar gaseous nebulae.

He found that the vast majority of gaseous nebulae in the Milky Way came into being by the formation of extremely luminous stars on the outer surface of these large, dark clouds. After their formation, these stars ionise their environment, which up until that point had been neutral. The ionisation front digs into the cloud as it grows, causing a pressure differential with the thin, rarefied gas outside the cloud. The ionised gas rushes outward, moving far faster than the stars that illuminate it.

All this was in contradiction to the common theory of the time, according to which [stars](#) form in the centres of clouds; however, in spite of the

paradigm shift, the new [theory](#) rapidly became an accepted view of nebula formation.

For this new video, researchers working at the Space Telescope Science Institute in Baltimore and the Caltech/Infrared Processing and Analysis Center in Pasadena have combined scientific techniques and data with special effects and computer graphics. The video is being distributed to American observatories and museums hoping to provide their visitors with a crystal clear picture of these ideas—ideas that found their origins some forty years ago, at the Leiden Observatory.

Provided by Leiden University

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