More star births than astronomers have calculated

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The "birth rate" for stars is certainly not easy to determine. Distances in the universe are far too great for astronomers to be able to count all the newly formed celestial bodies with the aid of a telescope. So it is fortunate that the emerging stars give themselves away by a characteristic signal known as "H-alpha" emissions. The larger the number of stars being formed in a particular region of the firmament, the more H-alpha rays are emitted from that region.

"H-alpha emissions only occur in the vicinity of very heavy stars," explains Jan Pflamm-Altenburg of the Argelander Institute of Astronomy at Bonn University. It has long been accepted that heavy and light stars are always born in a certain ratio to each other. One "H-alpha baby" is thought to be accompanied by 230 lighter stars with a mass too low for them to emit H-alpha rays.

However, new observations make this theory untenable. On the edges of "disc galaxies" (like the Milky Way) the H-alpha radiation ceases abruptly. For a long time astronomers concluded from this finding that no stars are being born in this region. "The explanation offered is simply that too little gaseous matter exists for it to collapse into balls and form stars," says Jan Pflamm-Altenburg. "These theories largely inform our understanding of how galaxies developed from the Big Bang to the present."

Satellite mission baffles astronomers

A satellite mission has recently revealed that stars are in fact being formed beyond the H-alpha perimeter. These stars are, without exception, so light that no H-alpha radiation is emitted. Consequently, the numerical ratio of 230 light stars to one heavy star does not apply to the edges of galaxies. "This observation presented the astronomy community with quite a conundrum," says Professor Dr. Pavel Kroupa of the Argelander Institute.

Kroupa and Pflamm-Altenburg have come up with a solution which, they say, is basically very simple. They note that star births are not evenly distributed across galaxies but are focused on the star clusters – well known examples being the Seven Sisters and the Orion Nebula. And only large, high-mass clusters produce heavy stars, i.e. the newborn stars that can create the H-alpha emission. "But these heavy star clusters primarily occur in the core regions of disc galaxies," says Jan Pflamm-Altenburg. "Towards the edges they become increasingly rare. The outer regions tend to contain smaller clusters in which the formation of lighter stars is more frequent."

The conclusion is that a numerical ratio of 230 to 1 is only valid for the centres of galaxies. On the edges of galaxies each "H-alpha baby" might be accompanied by a thousand or more light stars. Those astronomers who always use the same factor when calculating total star formations from their H-alpha readings therefore underestimate the number of newborn stars.

The theoretical work of the two Bonn-based astrophysicists supports affirms that the mass of new stars depends linearly on the mass of the gas in their vicinity. Their conclusions open up completely new perspectives for research into the development of galaxies.

Source: University of Bonn