

Origins of the Milky Way

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An optical image of the dwarf galaxy in Sculptor. Astronomers have found a very old star in this galaxy, in support of the idea that some of the Milky Way's old stars were once residents of neighboring galaxies.

(PhysOrg.com) -- According to current astronomical models, the Milky Way and other large galaxies formed over billions of years in a process that involved interactions between smaller galaxies, and in particular the gradual capture of many stars from nearby dwarf galaxies (small galaxies with hundreds or thousands of times fewer stars than the Milky Way).

Our current galactic neighborhood hosts one other comparably large galaxy, [Andromeda](#), and several dozen dwarf galaxies of various types, including the so-called Magellanic Clouds and a dwarf galaxy called the

Sculptor Dwarf Galaxy. [Astronomers](#) piecing together the history of the Milky Way, including its genetic heritage from neighbors, recognize that our story also very likely reflects the cosmic story of how galaxies everywhere are assembled.

The Sculptor [Dwarf Galaxy](#) is about 300,000 light-years away, and is notable because among other things it contains many [stars](#) that are lacking in heavy elements like iron. Since iron is produced very gradually inside stellar furnaces, a dearth of iron shows that the system (including its stars) is old, and dates from a time before these elements became abundant.

In the case of Sculptor, its stars on average have only a few percent of the heavy elements that we see in the sun. The outer halo of the Milky Way has some much older stars though, some with only one-ten-thousandth of the iron in the sun, or even less.

The problem is this: if the Milky Way did form in part by capturing stars from its neighboring dwarf galaxies, those dwarfs should have stars at least as old as ours, if not older. Why, wondered astronomers, have none been seen?

Writing in the latest issue of *Nature*, CfA astronomer Anna Frebel and two colleagues describe their discovery of a very old, metal-poor star in Sculptor. The scientists were concerned that previous conclusions were based either on studies of too few stars, or on incomplete diagnostics that used a misleading heavy element. Using a new method, they identified a set of stars in Sculptor that looked like possible old candidates, and then observed them with detailed optical spectroscopy.

They discovered that one of these stars was indeed extremely old - it has an iron abundance less than 0.25% of the sun's, making it a close analog of the old stars in the [Milky Way](#) halo and comparable in age to the age

of the universe. The results are interesting in themselves, but also because they reinforce the notion that our galaxy has stars that did once belong to our neighbors.

More information: Linking dwarf galaxies to halo building blocks with the most metal-poor star in Sculptor, *Nature* 464, 72-75 (4 March 2010), [doi:10.1038/nature08772](https://doi.org/10.1038/nature08772)

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