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Astronomers have a few tools to study stars that let them figure out relative ages, such as looking at their temperatures and brightness. In general, reddish and orange stars are older and cooler, while blueish white stars are hotter and younger. Stars like the Sun can be considered "middle-aged" since their ages lie somewhere between their cool red elders and their hot younger siblings. The general rule is that hotter and much more massive stars, such as the blueish stars show in this image, are likely to live shorter lives. But, what clues exist to tell astronomers how long those lives will be? This region of space contains very hot, young stars. How long they live and how they die tells a lot about the life cycles of stars across the cosmos. The very massive star R136a1 lies in this star-forming region in the Large Magellanic Cloud (a neighbor galaxy to the Milky Way). NASA/ESA/STScI There's an extremely useful tool that astronomers can use to figure out ages of stars that ties directly into how old the star is. It uses the spin rate of a star (that is, how fast it spins on its axis). As it turns out, stellar spin rates slow down as stars age. That fact intrigued a research team at Harvard-Smithsonian Center for Astrophysics, led by astronomer Soren Meibom. They decided to construct a clock that can measure the stellar spins and thus determine the star's age. Being able to tell the ages of stars is the basis for understanding how astronomical phenomena involving stars and their companions unfold over time. Knowing a star's age is important for many reasons having to do with star formation rates in galaxies as well as the formation of planets. Artist's concept of a protoplanetary disk around a newly formed star. NASA It's also particularly relevant to the search for signs of alien life outside our solar system. It has taken a long time for life on Earth to attain the complexity we find today. With an accurate stellar clock, astronomers can identify stars with planets that are as old as our Sun or older. A star's spin rate depends on its age because it slows down steadily with time, like a top spinning on a table slows down after a few minutes. A star's spin also depends on its mass. Astronomers have found that larger, heavier stars tend to spin faster than smaller, lighter ones. There is a close mathematical relationship between mass, spin, and age. Measure the first two, and it's relatively easy to calculate the third. An artist's impression of a white dwarf star in orbit with pulsar PSR J2222-0137. It may be the coolest and dimmest white dwarf ever identified. The spin rate of this star gives astronomers clues to its aging process. B. Saxton (NRAO/AUI/NSF) This method was first proposed in 2003, by astronomer Sydney Barnes of the Leibniz Institute for Physics in Germany. It's called "gyrochronology" from the Greek words gyros (rotation), chronos (time/age), and logos (study). For gyrochronology ages to be accurate and precise, astronomers must calibrate their new stellar clocks by measuring the spin periods of stars with both known ages and masses. Meibom and his colleagues previously studied a cluster of billion-year-old stars. This new study examines stars in the 2.5-billion-year-old cluster known as NGC 6819, thereby significantly extending the age range. To measure a star's spin is not an easy task. No one can tell just by looking at a star how fast it's turning. So, astronomers look for changes in its brightness caused by dark spots on its surface—the stellar equivalent of sunspots. Those are part of the Sun's normal activiti and can be tracked just as starspots can. Unlike our Sun, however, a distant star is an unresolved point of light. So, astronomers can't directly see a sunspot cross the stellar disk. Instead, they watch for the star to dim slightly when a sunspot appears, and brighten again when the sunspot rotates out of view. These changes are very difficult to measure because a typical star dims by much less than 1 percent. And, time is an issue. For the Sun, it can take days for a sunspot to cross the star's face. The same is true of stars with starspots. Some scientists have gotten around that by using data from NASA's planet-hunting Kepler spacecraft, which provided precise and continuous measurements of stellar brightnesses. One team examined more stars weighing 80 to 140 percent as much as the Sun. They were able to measure the spins of 30 stars with periods ranging from 4 to 23 days, compared to the present 26-day spin period of the Sun. The eight stars in NGC 6819 most similar to the Sun have an average spin period of 18.2 days, strongly implying that the Sun's period was about that value when it was 2.5 billion years old (about 2 billion years ago). The team then evaluated several existing computer models that calculate the spin rates of stars, based on their masses and ages, and determined which model best matched their observations. Spin rate helps astronomers determine information about the age and evolution of a star.Researchers continually study spin rates to understand how different types of stars change through time.Our Sun, like other stars, spins on its axis.

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