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The Lifetime of Protoplanetary Disks in Low-metallicity Environments

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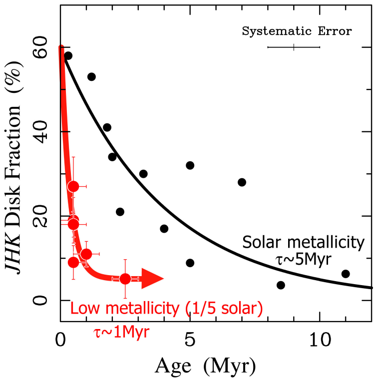
Although as many as over 500 exoplanets are now known, these planets are unexpectedly found to be diverse in terms of, e.g., mass, orbital period, and eccentricity. Perhaps the most telling discovery in exoplanet study is the "planet-metallicity correlation," the higher probability of a star hosting a giant planet with increasing metallicity, suggesting that metallicity could be the most crucial parameter for giant planet formation.

We studied near-infrared disk fractions of six young clusters in the low-metallicity environments (~1/10 solar metallicity) using deep JHK images with Subaru 8.2 m telescope. We found that disk fraction of the low-metallicity clusters declines rapidly in $<$1 Myr, which is much faster than the ~5-7 Myr observed for the solar-metallicity clusters (see Figure), suggesting that disk lifetime shortens with decreasing metallicity possibly with an ~10^{Z} dependence. Since the shorter disk lifetime reduces the time available for planet formation, this could be one of the major reasons for the strong planet-metallicity correlation. Although more quantitative observational and theoretical assessments are necessary, our results present the first direct observational evidence that can contribute to explaining the planet-metallicity correlation.



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