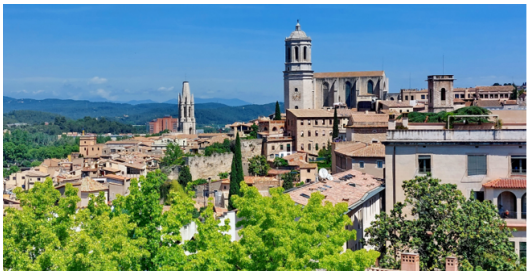

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Isomeric State of 176Lu^m and Robustness of A Stellar Thermometer 176Lu/176Hf for the Main s-Process in AGB Stars

Both 176Lu (t1/2 ~36 Gyr) and 176Hf are the so-called "s-only nuclei"which are produced literally only by the main component of the slow neutron-capture process (main s-process) in AGB stars. The nucleosynthesis of the isomeric state 176Lu^m (t1/2 ~3 h) predominates the 176Lu/176Hf ratio because the system does not reach the thermal equilibrium at the temperature of the main s-process. We made a model of the main s-process during interpulse phases of metal-poor AGB stars, LP625_44 and CS31062-012, and carried out comprehensive nucleosynthesis calculations including isomeric state 176Lu^m in addition to the ground state 176Lu^g with the use of new nuclear physic inputs from Misch et al. 2020 [1]. We then found that the calculated 176Lu/176Hf ratio ~ 0.69 turns out to be independent of the stellar metallicity [2]. This is due to the effect of predominant nucleosynthesis of isomeric state of 176Lu in either stars, indicating that the 176Lu/176Hf ratio can be a robust stellar thermometer of the main s-process in AGB stars [2].

References

[1] Misch, G. Wendell et al. (Dec. 2020). "Astromers: Nuclear Isomers in Astrophysics*". In: The Astrophysical Journal Supplement Series 252.1, p. 2. doi: 10.3847/1538- 4365/abc41d. url: https://dx.doi.org/10.3847/1538-4365/abc41d.

[2] Xin-xu Wang, Yudong Luo, Bao-Hua Sun and Toshitaka Kajino (2025), to be published.

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