Seminarium Astrofizyczne

wtorek 27.04.2021 godz. 12:30

https://www.gotomeet.me/NCBJmeetings/seminarium-astrofizyczne
ID 349-387-373
Password: AstroSemi

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Mixing and Nuclear Uncertainties in Low-Metallicity AGB Stars:
The Impact on Stellar Structure and Nucleosynthesis

The slow neutron-capture process(s-process) is one of the two main processes forming elements heavier than iron in stars. Its efficiency critically depends on key $(\alpha,n)$ reactions, which represent the main sources of neutrons to trigger the neutron-capture chain producing all elements up to bismuth, and on the modeling of convective boundaries. I present the evolution and s-process nucleosynthesis of low-mass AGB stars at low metallicities using the MESA stellar evolution code. The combined data set includes models with initial masses $M_{\text{ini}}/M_{\odot} = 2$ and $3$ for initial metallicities around one tenth that of the Sun. The nucleosynthesis was calculated for all relevant isotopes by post-processing with the NuGrid mppnp code. Theoretical predictions are compared with observed surface abundances on low-metallicity stars, finding that mixing processes at the interface between the He-intershell and the CO-core play a critical role in the s-process at low metallicities, and that models with a $13C$-pocket size of at least $\sim 3 \times 10^{-4} \, M_{\odot}$ are strongly favored in reproducing observations. Additionally, these results indicate that recent re-evaluation incorporating indirect measurements of the $22Ne(\alpha,n)25Mg$ reaction rate strongly impact our stellar nucleosynthesis calculations, bringing them into much better agreement with key observables.

Serdecznie zapraszam,
Agnieszka Majczyna